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Chapter 4
Other CEQA-Required Analysis

This chapter identifies cumulative impacts, significant and unavoidable impacts, significant irreversible environmental changes, and growth-inducing impacts.

4.1 Cumulative Impacts

CEQA defines cumulative impacts as "two or more individual effects which, when considered together, are considerable," and suggests that cumulative impacts may "result from individually minor but collectively significant projects taking place over a period of time" (State CEQA Guidelines Section 15355). CEQA documents are required to include a discussion of potential cumulative effects when those effects would be significant, and the State CEQA Guidelines suggest two possible methods for assessing potential cumulative effects: 1) the "list" approach and 2) the "projection" approach (State CEQA Guidelines Section 15130).

The focus of analysis is to identify the Proposed Project's *contribution* to cumulative impacts that are significant and to assess whether the Proposed Project's contribution would be considerable. Where the Proposed Project would have no impact on a resource or can be clearly shown to have a less-than-considerable contribution to potential cumulative impacts, the discussion of cumulative impacts is brief. Where cumulative impacts can be shown to be less than significant in the area where the Proposed Project would contribute, the discussion is also brief. Where the Proposed Project has a potential to contribute considerably to a significant cumulative impact, the analysis is more detailed but remains focused on the Proposed Project's potential contribution rather than articulating the cumulative impact comprehensively.

Under CEQA, the Peninsula Corridor Joint Powers Board (JPB) is not responsible to mitigate the overall cumulative impact. Specifically, the High-Speed Rail (HSR) Blended Service (described fully in Section 4.1.3.1, *Rail Projects Planned within the Caltrain Corridor*) is not the Proposed Project being analyzed in this EIR or that is being considered by the JPB for potential approval. The JPB is responsible for analyzing potentially feasible mitigation to address the Proposed Project's considerable contributions to identified significant cumulative impacts only. Thus, the obligation to assess mitigation is limited to the "fair share" portion of a significant cumulative impact that is due to the Proposed Project's considerable contribution. Other cumulative projects have a similar obligation for their contributions to significant cumulative impacts. Thus, for example, in any future environmental evaluation of Blended Service, the California High-Speed Rail Authority (CHSRA) would be responsible for assessing feasible mitigation for its direct project impacts as well as any considerable contributions to significant cumulative impacts.

4.1.1 Approach and Methodology

CEQA Guidelines Section 15130(b) states that the discussion of cumulative impacts should include:

- Either 1) a list of past, present, and probable future projects producing related or cumulative impacts or 2) a summary of projections contained in an adopted general plan or similar

document, or in an adopted or certified environmental document, that described or evaluated conditions contributing to a cumulative impact.

- A discussion of the geographic scope of the area affected by the cumulative impact.
- A summary of expected environmental effects to be produced by these projects.
- Reasonable, feasible options for mitigating or avoiding the project's contribution to any significant cumulative effects.

This EIR used a hybrid approach, explained below, to best disclose different cumulative impacts.

- *Projections*: This approach is used to disclose broad regional cumulative impacts related to regional air quality, greenhouse gas emissions, public services and utilities, and transportation/traffic (for general growth driving traffic and transit use).
- *List Approach*: Specific projects in or adjacent to the Caltrain corridor from San Francisco to San Jose were examined for the potential, along with the Proposed Project, to result in cumulatively significant localized impacts. This analysis considered transportation projects proposed for the Caltrain Corridor, as well as land development projects that are planned directly adjacent to the Caltrain Corridor. The list approach was used for analyzing impacts related to aesthetics, local air quality, biological resources, cultural resources, electromagnetic fields and electromagnetic interference (EMF/EMI), geology, soils and seismicity, hazards and hazardous materials, hydrology and water quality, land use and recreation, noise and vibration, and transportation/traffic (for analysis of construction transportation and traffic effects and for transportation improvements assumed for cumulative ridership and traffic analysis).

Table 4-1 summarizes the methodology used for each cumulative subject analysis as well as the geographic area of analysis.

As described in Section 3.0, *Approach to Impact Analysis*, the Proposed Project would have no impact on mineral resources or agricultural resources. Because the Proposed Project would have no impact, it cannot contribute to any potential cumulative impacts and these resource areas are not discussed further in the cumulative impact analysis.

4.1.2 Projections/Regional Growth Characteristics

The Association of Bay Area Governments (ABAG) projections of land use and population growth were used to estimate overall growth in San Francisco, San Mateo and Santa Clara Counties. These projections are shown in Table 4-2. The Santa Clara Valley Transportation Authority (VTA) travel demand forecasting model (VTA Model[1]) VTA was used to develop the travel forecasts for development and growth through the year 2040 in the corridor. The ridership estimates[2] and the ABAG projections of land use and growth were also used to model traffic conditions along the corridor.

[1] VTA's transportation model is an analytical tool that predicts travel patterns based upon spatial relationship between socio-economic characteristics of population and employment locations, tripmaking and economic-related activities in those areas and interconnecting transportation facilitates, including roadway, transit and bicycle and pedestrian modes of travel. The VTA *Local Transportation Model Consistency Guidelines* (2009) outlines how the model may be used by local jurisdictions to develop the local transportation models.

[2] As noted in Section 3.14, ridership is reported using boardings in this EIR, not boardings plus alightings.

Table 4-1. Summary of Cumulative Impact Methodology

Resource Issue	Cumulative Method	Geographic Area of Impact
Aesthetics	List	Caltrain ROW and vicinity
Air Quality	Projection (Criteria Pollutants)	Criteria pollutants: San Francisco Bay Area Air Basin
	List (Toxic Air Contaminants)	Toxic air contaminants: Caltrain ROW and immediate vicinity
Biological Resources	List	Terrestrial species: Caltrain ROW and immediate vicinity
		Aquatic species: ROW, vicinity and downstream
Cultural Resources	List	Caltrain ROW and adjacent
EMF/EMI	List	Caltrain ROW and adjacent
Geology, Soils and Seismicity	List	Caltrain ROW and adjacent
GHG Emissions and Climate Change	Projection (GHG emissions)	The planet (GHG emissions)
	List (vulnerability to Climate change impacts)	San Francisco Peninsula (vulnerability to climate change Impacts)
Hazards and Hazardous Materials	List	Caltrain ROW and adjacent
Hydrology and Water Quality	List	Caltrain ROW and downstream water bodies
Land Use and Recreation	List	Caltrain ROW and adjacent
	Projection (recreation demand)	
Noise and Vibration	List	Caltrain ROW and adjacent
Population and Housing	Projection	San Francisco, San Mateo, and Santa Clara Counties
Public Services and Utilities	List (Construction Disruption)	Caltrain ROW and adjacent (Construction)
	Projection (Operations)	Service areas of regional providers to project sites (Operations)
Transportation/ Traffic	List (Construction Analysis and Transportation Improvements)	Caltrain ROW, roadways crossing ROW and roadways near stations (traffic level of service, bicycle and pedestrian facilities)
	Projection (Operational Traffic)	San Francisco Peninsula (regional traffic, regional transit systems)

Table 4-2. 2010–2040 Population, Housing and Employment Growth in the Counties of the Caltrain Corridor

	Total Population				Occupied Housing Units				Employment (Total Jobs)			
Area	2010	2040	Change	% Diff	2010	2040	Change	% Diff.	2010	2040	Change	% Diff.
San Francisco County	805,235	1,076,305	271,070	34	345,811	447,248	101,437	29	568,730	760,230	191,500	34
San Mateo County	718,451	899,169	180,718	25	257,837	316,868	59,031	23	346,320	462,870	116,550	34
Santa Clara County	1,781,642	2,411,704	630,062	35	604,204	819,607	215,403	36	906,270	1,263,834	357,564	40

Note: The data for 2040 is based on data derived used in the VTA system ridership model. As explained in Appendix I, the socioeconomic data used for the ridership model was based on available ABAG SCS forecasts in late 2012 when project EIR analysis began. The ABAG 2013 projections released in fall 2013 are slightly different, but the differences are not large enough to have a significant influence on the ridership forecasts or on the EIR traffic analysis.

Source: U.S. Census 2010; Appendix I, *Ridership Technical Memorandum*.

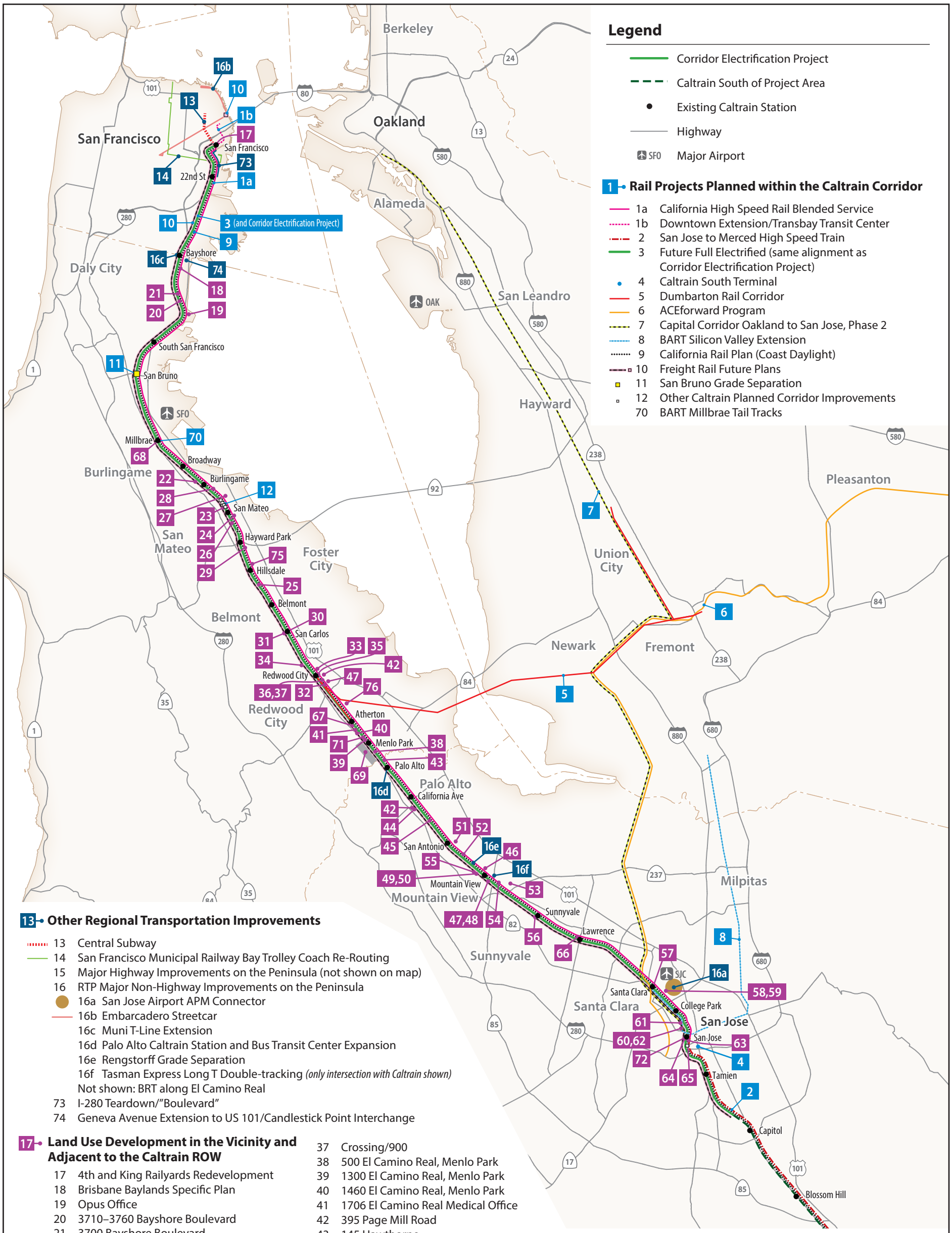
4.1.3 Projects Considered

Reasonably foreseeable future projects are defined as the projects that have been adopted or have otherwise demonstrated likelihood to occur based on documentation from project sponsors.

There are three types of cumulative projects considered: rail projects planned within the Caltrain Corridor, other regional transportation improvements, and land development adjacent to the Caltrain ROW. For land development along the Caltrain ROW, the JPB requested lists of reasonably foreseeable projects from cities along the Caltrain and additional projects were added based on general knowledge. The geographic areas considered for cumulative impact analyses vary by individual resource, and can include different scales of impact (such as for criteria pollutants or greenhouse gases). The geographic area is noted in the beginning of each subject analysis.

Table 4-3 presents the applicable planning jurisdictions, the potential cumulative impact areas, the estimated construction schedule associated with each cumulative project, and the distance of the cumulative project to the Caltrain ROW. The project numbers in Table 4-3 correspond to the project numbers in Figure 4-1. Figure 4-1 shows the approximate location of each project with respect to the Caltrain ROW and proposed project components. The column titled "Potential Cumulative Impact Areas" generally summarizes the anticipated cumulative impact areas known at this time. Project information listed in Table 4-3 is based on information supplied by the cities the surrounding Caltrain ROW and available environmental documents and information posted on agency websites.

The source of cumulative project information, unless otherwise noted in text below, is the references noted at the end of Table 4-3 ~~4-2~~.



Note: This figure replaces Figure 4-1 from the Draft EIR.

Figure 4-1
Projects Considered in the Cumulative Analysis
Peninsula Corridor Electrification Project

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Table 4-3. Projects Considered In the Cumulative Analysis

Project Number	Jurisdiction	Project Title	Potential Cumulative Impact Areas	Estimated Construction Schedule	Location relative to the Proposed Project (miles)	Potential Conflicts between Proposed Project and Cumulative Project?
Rail Projects Planned within the Caltrain Corridor						
1a	San Jose – San Francisco	California High-Speed Rail Phase 1 Blended Service ~~(including Transbay Terminal Center and Downtown Extension Project)~~	**Construction:** Separated in time; but overlap from San Jose to San Francisco. Air Quality; Biological Resources, Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality; Noise; Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics; Air Quality; Biological Resources; EMF/EMI; GHG emissions; Hydrology and Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Estimated completion by sometime between 2026 and 2029; assumed construction sometime after 2020 ~~2019~~ but before 2026/2029.	In the Caltrain corridor from San Francisco to San Jose ~~and the 1.3 miles from San Francisco Transbay Transit Center to the San Francisco 4th and King Station~~	~~None, but d~~Design of passing tracks, and Diridon and Millbrae Stations may require realignment of some Proposed Project OCS poles and wires (as well any proposed grade separations). Track upgrades and reconfiguration to increase line speeds up to 110 mph and potential improvements at the 4th and King Street station and system improvements depending on revenue service date and systems to be determined.
1b	San Francisco	Transbay Transit Center and Downtown Extension Project	**Construction:** Separated in time; but overlap from north of 16th street to 4th and King Street in San Francisco. Air Quality; Biological Resources, Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality; Noise; Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics; Air Quality; Biological Resources; EMF/EMI; GHG emissions; Hydrology and Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	TTC in construction now. Assumed DTX construction sometime after 2020 but before 2026/2029.	In the Caltrain corridor from north of 16th Street to 4th and King and the 1.3 miles from 4th and King to the San Francisco Transbay Transit Center	Construction within 4th and King station/yard for DTX may disrupt Caltrain service and will require coordination between TJPA and Caltrain. As DTX no longer includes full platform reconfiguration at 4th and King, this is no longer a DTX issue.
2	San Jose – Merced	San Jose to Merced High-Speed Train (as part of Phase 1 blended system)	**Construction:** Separated in time but overlap at Diridon Station only. Air Quality; Biological Resources, Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology & Water Quality; Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; Biological Resources; EMF/EMI; GHG emissions; Hydrology and Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2021–2026	Overlap with Caltrain corridor only at San Jose Diridon Station; project then heads southeast away from Caltrain ROW	None, but design of Diridon Station may require realignment of some Proposed Project OCS poles and wires.
3	San Jose – San Francisco	Future Full Electrified	**Construction:** No construction impacts, only replacement of rolling stock. **Operations:** Air Quality, EMF/EMI, GHG Emissions, Noise and Vibration.	Complete between 2020 and 2026/2029	Caltrain ROW	None
4	Santa Clara, San Jose	Caltrain South Terminal (Phase II and III)	**Construction:** Overlap between Santa Clara and Tamien Stations and in time. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology & Water Quality; Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Service increases included in other projects so impacts only related to permanent physical improvements. Aesthetics, Hydrology and Water Quality; and Land Use and Recreation.	2017–2023	Caltrain ROW	None but construction will require coordination.
5	City of Menlo Park, City of East Palo Alto, City of Union City, City of Fremont, City of Newark, City of Redwood City	Dumbarton Rail Corridor	**Construction:** No construction in Caltrain corridor, but construction east of corridor in Redwood City. No overlap in time or location. Air Quality; Biological Resources, Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology & Water Quality; Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Air Quality; GHG emissions; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Sometime after 2020	Caltrain ROW	None

Project Number	Jurisdiction	Project Title	Potential Cumulative Impact Areas	Estimated Construction Schedule	Location relative to the Proposed Project (miles)	Potential Conflicts between Proposed Project and Cumulative Project?
6	Stockton – San Jose and Stockton – Merced	ACEforward Program	**Construction:** No construction in Caltrain ROW (covered by South Terminal Project) so no overlap in area, but potential overlap in time. Nearest potential area of construction would be Alviso wetlands area. Air Quality; Biological Resources, Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology & Water Quality; Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Overlap from Santa Clara to San Jose only. Air Quality; GHG emissions; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2018–2022 or after	Within Caltrain ROW from San Jose to Santa Clara; then forks east towards City of Fremont along Union Pacific Rail Road track	None
7	City of San Jose, City of Fremont, City of Santa Clara, City of Emeryville, City of Oakland	Capital Corridor Oakland to San Jose, Phase 2	**Construction:** No construction in Caltrain ROW (covered by South Terminal Project) so no overlap in area. Nearest area of construction would be Santa Clara double track area. Potential overlap in time. Air Quality; Biological Resources, Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology & Water Quality; Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Overlap from Santa Clara to San Jose only. Air Quality; GHG emissions; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2016–2023 or after	Within Caltrain ROW from Santa Clara to San Jose only	None
8	City of San Jose, City of Santa Clara	BART Silicon Valley Extension	**Construction:** Overlap in time and in area from Santa Clara Station to Diridon Station. Air Quality; Biological Resources, Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology & Water Quality; Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Overlap in adjacent operations from Santa Clara to San Jose only. Aesthetics; Air Quality; EMF/EMI; GHG emissions; Noise and Vibration; Public Services and Utilities.	2012–2023	Caltrain ROW at Santa Clara Station	None but connections between BART and Caltrain stations at Diridon and Santa Clara will require coordination
9	San Jose – San Francisco	*California State Rail Plan* (Coast Daylight)	**Construction:** No construction in corridor. **Operations:** Air Quality, GHG emissions, Noise and Vibration, Transportation and Traffic.	No construction in corridor; Service date start by 2020	Caltrain ROW from San Jose to San Francisco	None
10	San Jose – San Francisco	Freight Rail Future Plans	**Construction:** No construction needed for current freight trains; Use of taller trains in future could ~~may~~ require construction to provide clearances at bridges and tunnels. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology & Water Quality; Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Air Quality; GHG emissions; Noise and Vibration; Public Services and Utilities.	Incremental over time; specific timing unknown	Caltrain ROW	Trains taller than current trains could ~~may~~ require construction to provide clearances at bridges and tunnels. ~~New freight will have to comply with FRA temporal separation requirements.~~
11	City of San Bruno	San Bruno Grade Separation Project	**Construction:** No overlap in time but overlap in location in San Bruno. Air Quality; Biological Resources, Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology & Water Quality; Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics; Noise and Vibration; Transportation and Traffic.	2010–2014	Caltrain ROW	None; project will be completed before Proposed Project.
12	Cities of San Mateo, Santa Clara, and San Jose and other location	Other Caltrain Planned Corridor Improvements	**Construction:** Would overlap in location and some improvements would overlap in time. Air Quality; Biological Resources, Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology & Water Quality; Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics; Air Quality; GHG emissions; Noise and Vibration; Public Services and Utilities	2013 onward	Caltrain Corridor and project vicinity	None, but may require coordination during construction. Potential OCS pole and wire relocation depending on timing of platform improvements at 4th and King.
70	City of Millbrae	BART Millbrae Tail Tracks	**Construction:** Overlap south of Millbrae Station. Potential overlap in time. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology & Water Quality; Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics; Air Quality; EMF/EMI; GHG emissions; Noise and Vibration; Public Services and Utilities.	Assumed by 2020 ~~2019~~	Caltrain ROW	May require coordination on placement of OCS poles and wires south of Millbrae BART station.

Project Number	Jurisdiction	Project Title	Potential Cumulative Impact Areas	Estimated Construction Schedule	Location relative to the Proposed Project (miles)	Potential Conflicts between Proposed Project and Cumulative Project?
Other Regional Transportation Improvements						
13	City and County of San Francisco	Central Subway	**Construction:** Overlap in time and adjacent area at San Francisco 4th and King Station. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology & Water Quality; Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Air Quality; EMF/EMI; GHG emissions; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2010–2019	Caltrain ROW	None but construction coordination may be required if both projects are active near San Francisco 4th and King Station at same time.
14	City and County of San Francisco	San Francisco Municipal Railway Bay Trolley Coach Re-Routing	**Construction:** Overlap at 16th Street crossing of Caltrain ROW and possibly in time. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology & Water Quality; Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Air Quality; EMF/EMI; GHG emissions; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Sometime before 2019	Passes over Caltrain tunnel ROW	Potential conflict requires technical solution to resolve crossing of two incompatible OCS power systems at 16th Street crossing
15	Caltrans, VTA (Various jurisdictions)	Major Highway Improvements on the Peninsula	Includes following projects: VTA Silicon Valley Express Lanes Program; U.S. Highway 101 improvements including HOV/T lane from San Francisco county line to Whipple Avenue; express lanes between Whipple Ave. and Cochrane Road, and auxiliary lanes from Marsh Road to Embarcadero Road to State Route 85; and U.S. Highway 101 corridor interchange improvements at Candlestick Point (San Francisco), Produce Avenue (South San Francisco), SR 92 (San Mateo), Oregon Expressway (Palo Alto), and Zanker Road (San Jose). **Construction:** Possible overlap in time but no overlap in location. Air Quality; Biological Resources; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality; Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Air Quality; GHG emissions; Hydrology & Water Quality; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Varies	Less than 0.2	None
16	Caltrans, VTA (Various jurisdictions)	RTP Major Non-Highway Improvements on the Peninsula	Includes following projects: Embarcadero Streetcar (San Francisco); Southern Intermodal Terminal and MUNI T-Line Extension (San Francisco); Future grade separations in San Mateo County; Bus Rapid Transit along El Camino Real; Palo Alto Caltrain Station and Bus Transit Center Expansion; Grade separation at Rengstorff Avenue; Tasman Express Long T double tracking: Mineta San Jose International Airport Automated People Mover Connector. **Construction:** Possible overlap in time and location. Air Quality; Biological Resources; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Air Quality; EMF/EMI; GHG emissions; Hydrology & Water Quality; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Varies	Caltrain ROW; and 1.0[a]	Coordination needed between grade-separation projects and OCS pole and wire design.
73	City and County of San Francisco	I-280 Teardown/ "Boulevard"/ 4th and King underground station	**Construction:** No overlap in time but overlap in location at 4th and King Station, Caltrain ROW south to 23rd Street. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology & Water Quality; Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown	4th and King Station, Caltrain ROW south to 24rd Street, I-280 in San Francisco and additional areas	Yes. Project likely to be after 2020 ~~2019~~ based on current status of planning. May require new tunnel for Caltrain/HSR from 23rd to 4th and King and/or complete rebuild of 4th and King Station.
74	City of Brisbane	Geneva Avenue to US 101/Candlestick Point Interchange	**Construction:** Overlap in location at Tunnel Avenue and proposed extension of Geneva Avenue, and in time. Air Quality; Cultural Resources; GHG emissions; Hazards and Hazardous Materials; Hydrology & Water Quality; Noise, Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Noise and Vibration; Transportation and Traffic.	2015-2020	Caltrain ROW	Coordination require for OCS poles and grade separation at Tunnel Avenue.

Project Number	Jurisdiction	Project Title	Potential Cumulative Impact Areas	Estimated Construction Schedule	Location relative to the Proposed Project (miles)	Potential Conflicts between Proposed Project and Cumulative Project?
Land Development in the Vicinity and Adjacent to Caltrain ROW						
17	City and County of San Francisco	4th and King Railyards Redevelopment	**Construction:** No overlap in time but overlap in location at 4th and King. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology & Water Quality; Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown (likely after 2020 ~~2019~~)	Adjacent, and in OCS/ESZ area outside ROW.	Potentially depending on station configuration. Project likely to be after 2020 ~~2019~~ based on current status of planning. May require relocation of OCS pole at wires at station.
18	City of Brisbane	Brisbane Baylands Specific Plan	**Construction:** Overlap in location and directly adjacent. Air Quality; Biological Resources, Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Phased over 20 years (2015–2035)	Adjacent, and in OCS/ESZ area outside ROW	Proposed Project will have minor encroachments on land included in specific plan which won't change overall plans but may require minor adjustments.
19	City of Brisbane	Opus Office	**Construction:** No overlap in location. Air Quality; Biological Resources, Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown; likely before 2020 ~~2019~~	0.10	None
20	City of Brisbane	3710–3760 Bayshore Boulevard	**Construction:** No overlap in location. Air Quality; Biological Resources, Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown; likely before 2020 ~~2019~~	0.02	None
21	City of Brisbane	3700 Bayshore Boulevard	**Construction:** No overlap in location. Air Quality; Biological Resources, Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown; likely before 2020 ~~2019~~	0.02	None
68	City of Millbrae	Millbrae BART Station TOD	**Construction:** No overlap in location but directly adjacent. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown; likely before 2020 ~~2019~~	Adjacent	None, but may require coordination during construction.
22	City of Burlingame	1225 Floribunda Avenue	**Construction:** No overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown; likely before 2020 ~~2019~~	0.08	None
23	City of San Mateo	Mi Rancho Market	**Construction:** No overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown; likely before 2020 ~~2019~~	0.02	None

Project Number	Jurisdiction	Project Title	Potential Cumulative Impact Areas	Estimated Construction Schedule	Location relative to the Proposed Project (miles)	Potential Conflicts between Proposed Project and Cumulative Project?
24	City of San Mateo	Gas and Shop	**Construction:** No overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown; likely before 2020 ~~2019~~	0.13	None
25	City of San Mateo	Sadigh Mixed Use	**Construction:** No overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown; likely before 2020 ~~2019~~	0.03	None
26	City of San Mateo	Nazareth Terrace	**Construction:** No overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown; likely before 2020 ~~2019~~	0.06	None
27	City of San Mateo	Cal Water Operations Office	**Construction:** No overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown; likely before 2020 ~~2019~~	0.11	None
28	City of San Mateo	800 & 888 N. San Mateo Drive Apartments	**Construction:** No overlap in time or location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2012–2013	0.11	None
29	City of San Mateo	2090 Delaware Apartments	**Construction:** No overlap in time or location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2013–2014	0.10	None
30	City of San Carlos	San Carlos Transit Village	**Construction:** Overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	To be determined	Adjacent, and in OCS/ESZ area outside ROW	Caltrain coordinating with project regarding OCS/ESZ location and project landscaping/vegetation.
31	City of San Carlos	Wheeler Plaza Redevelopment	**Construction:** No overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown; possibly before 2020 ~~2019~~	0.10	None

Project Number	Jurisdiction	Project Title	Potential Cumulative Impact Areas	Estimated Construction Schedule	Location relative to the Proposed Project (miles)	Potential Conflicts between Proposed Project and Cumulative Project?
32	City of Redwood City	145 Monroe Street	**Construction:** No overlap in time or location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2013–2014	0.07	None
33	City of Redwood City	Classics at Redwood City	**Construction:** No overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2013–2015	0.08	None
34	City of Redwood City	Finger Avenue	**Construction:** No overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown; likely before 2020 ~~2019~~	0.11	None
35	City of Redwood City	201 Marshall Street	**Construction:** No overlap in location or time. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2012–2014	0.03	None
36	City of Redwood City	Lathrop PARC	**Construction:** No overlap in time but overlap in location and directly adjacent. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2011–2014	Adjacent, and in OCS/ ESZ area outside ROW	Proposed Project will have minor encroachment for OCS/ESZ which may constrain uses directly along Caltrain ROW but should not affect project overall.
37	City of Redwood City	Crossing/900	**Construction:** No overlap in location but directly adjacent. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2013–2015	Adjacent	None but may require coordination during construction
67	Town of Atherton	Atherton Town Hall Complex	**Construction:** No overlap in location but directly adjacent. Air Quality; Biological Resources, Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown; possibly by 2020 ~~2019~~	Adjacent	None but may require coordination during construction.
71	City of Menlo Park	389 El Camino Real	**Construction:** No overlap in location or time. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2013/2014	0.06	None

Project Number	Jurisdiction	Project Title	Potential Cumulative Impact Areas	Estimated Construction Schedule	Location relative to the Proposed Project (miles)	Potential Conflicts between Proposed Project and Cumulative Project?
38	City of Menlo Park	500 El Camino Real	**Construction:** No overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown; likely before 2020 ~~2019~~	0.05	None
39	City of Menlo Park	1300 El Camino Real	**Construction:** No overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown; likely before 2020 ~~2019~~	0.08	None
40	City of Menlo Park	1460 El Camino Real	**Construction:** No overlap in time or location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2012–2014	0.11	None
41	City of Menlo Park	1706 El Camino Real Medical Office	**Construction:** No overlap in time or location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2012–2013	0.14	None
69	City of Menlo Park	El Camino Real/ Downtown Specific Plan	**Construction:** Overlap in time, location and adjacent. Air Quality; Biological Resources, Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Next 30 years	Adjacent, and in OCS/ ESZ area outside ROW	Proposed Project would have minor encroachments on land included in Specific Plan, which would not change overall plans but may require minor adjustments.
42	City of Palo Alto	395 Page Mill Road	**Construction:** No overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Applicant withdrew application. Construction unknown.	0.12	None
43	City of Palo Alto	145 Hawthorne	**Construction:** No overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown; possible before 2020 ~~2019~~	0.07	None
44	City of Palo Alto	195 Page Mill Road (Park Plaza)	**Construction:** Overlap in location and adjacent. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	In construction 2013 – 2014, ~~Unknown; likely before 2019~~	Adjacent, and in OCS/ESZ area outside ROW	Proposed Project would have ~~minor~~ no encroachments on private land included in project~~, which would not change overall plans but may require minor adjustments~~. PS5 Option 2 is ~~also~~ adjacent to this project. As noted in Section 3.1, coordination between the projects may be necessary concerning vegetative screening.

Project Number	Jurisdiction	Project Title	Potential Cumulative Impact Areas	Estimated Construction Schedule	Location relative to the Proposed Project (miles)	Potential Conflicts between Proposed Project and Cumulative Project?
45	City of Palo Alto	3445 Alma Street (Alma Plaza)	**Construction:** No overlap in time or location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2009–2013	0.08	No
46	City of Mountain View	100 Moffett Boulevard	Aesthetics, Air Quality; Cultural Resources; Geology, Soils, and Seismicity, Greenhouse Gas Emission and Climate Change, Hazards and Hazardous Materials, Land Use and Recreation; Noise and Vibration; Public Services and Utilities, and Transportation and Traffic.	Unknown; likely before 2020 ~~2019~~	0.03	No
47	City of Mountain View	209–405 West Evelyn	**Construction:** No overlap in time or location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2013–2014	0.03	No
48	City of Mountain View	100–200 West Evelyn	**Construction:** No overlap in time but overlap in location and adjacent. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2012–2014	Adjacent and in Proposed Project OCS/ESZ area outside ROW	Proposed Project would have minor encroachments on land included in project, which would not change overall plans but may require minor adjustments
49	City of Mountain View	902 Villa Street	**Construction:** No overlap in time or location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2013–2014	0.08	No
50	City of Mountain View	871 West Evelyn	**Construction:** No overlap in time but directly adjacent. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2012–2013	Adjacent	No
51	City of Mountain View	San Antonio Station	**Construction:** No overlap in location but directly adjacent. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown; possibly before 2020 ~~2019~~	Adjacent	No, but may require coordination during construction.
52	City of Mountain View	Northpark Apartments	**Construction:** No overlap in time or location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2013–2014	0.09	No
53	City of Mountain View	South Whisman Precise Plan	**Construction:** No overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown; possibly before 2020 ~~2019~~	0.20	No

Project Number	Jurisdiction	Project Title	Potential Cumulative Impact Areas	Estimated Construction Schedule	Location relative to the Proposed Project (miles)	Potential Conflicts between Proposed Project and Cumulative Project?
54	City of Mountain View	Tripointe Homes	**Construction:** No overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2013–2015	0.08	No
55	City of Mountain View	Pacific Press – Courtyard	**Construction:** Overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown; possibly before 2020 ~~2019~~	Adjacent and in Proposed Project OCS/ESZ area outside ROW	Proposed Project would have minor encroachments on land included in project, which would not change overall plans but may require minor adjustments.
56	City of Sunnyvale	Carmel Lofts	**Construction:** No overlap in time or location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2012–2014	0.08	No
66	City of Sunnyvale, City of Santa Clara	Lawrence Station Area Plan	**Construction:** Overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown; possibly before 2020 ~~2019~~	Adjacent and in Proposed Project OCS/ESZ area outside ROW	Proposed Project would have minor encroachments on land included in Area Plan, which would not change overall plans but may require minor adjustments.
57	City of Santa Clara	Santa Clara Station Area Plan	**Construction:** Overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown; likely before 2020 ~~2019~~	Adjacent and in Proposed Project OCS/ESZ area outside ROW	Proposed Project will have minor encroachments on land included in Area Plan which won't change overall plans but may require minor adjustments.
58	City of San Jose	Earthquakes Stadium	**Construction:** No overlap in time or location but directly adjacent. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2012–2014	Adjacent	None
59	City of San Jose	Former FMC site, aka Coleman Highline (PDC98-104, PD12-019)	**Construction:** No overlap in location but directly adjacent. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Construction to start in 2014 or 2015	Adjacent	None but may require coordination during construction.
60	City of San Jose	Alameda (PD12-017)	**Construction:** No overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Construction to start in 2015	0.06	None

Project Number	Jurisdiction	Project Title	Potential Cumulative Impact Areas	Estimated Construction Schedule	Location relative to the Proposed Project (miles)	Potential Conflicts between Proposed Project and Cumulative Project?
61	City of San Jose	Morrison Park Townhomes (PD06-094)	**Construction:** No overlap in time or location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2012–2014	0.08	None
62	City of San Jose	785-807 The Alameda (PDC13-007)	**Construction:** No overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2014–2015	0.11	None
63	City of San Jose	Baseball Stadium (PP05-214)	**Construction:** Overlap in location and adjacent. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Unknown	Adjacent and in Proposed Project OCS/ESZ area outside ROW	Proposed Project would have minor encroachments on land included in project, which would not change overall plans but may require minor adjustments.
64	City of San Jose	Park Avenue Senior and Family Housing (PDC13-012)	**Construction:** No overlap in location. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	2015–2017	0.02	None
65	City of San Jose	OSH West San Carlos (H13-008) (Now Lowe's)	**Construction:** Overlap in location and directly adjacent. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Approved; construction planned; date unknown	Adjacent and in Proposed Project OCS/ESZ area outside ROW	Proposed Project would have minor encroachments on land included in project, which would not change overall plans but may require minor adjustments.
72	City of San Jose	Diridon Station Area Plan	**Construction:** Overlap in location and adjacent. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Over next 2–3 decades	Adjacent and in Proposed Project OCS/ESZ area outside ROW	Proposed Project would have minor encroachments on land included in Area Plan, which would not change overall plans but may require minor adjustments.
75	City of San Mateo	Hillsdale Station Area Plan	**Construction:** Air Quality, Aesthetics, Transportation and Traffic, Noise and Vibration, GHG emissions, Geology and Soils, Hydrology and Water Quality: Hazards and Hazardous Materials **Operations:** Aesthetics, Air Quality, GHG Emissions, Noise and Vibration, Public Services and Utilities; Public Services, Transportation and Traffic: Hazards and Hazardous Materials	2011-2031	Adjacent and in Proposed Project OCS/ESZ area outside ROW	Current plan only applies to Caltrain is Caltrain requests redesignation of Caltrain ROW. Proposed Project would require minor reconfiguration of current vision for development on site if PS4, Option 1 or Option 2 but would not be major obstacle to plan implementation. PS4, Option 4 would require no reconfiguration.

Project Number	Jurisdiction	Project Title	Potential Cumulative Impact Areas	Estimated Construction Schedule	Location relative to the Proposed Project (miles)	Potential Conflicts between Proposed Project and Cumulative Project?
76	San Mateo County	North Fair Oaks Community Plan	**Construction:** Adjacent. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Next 25 to 30 years	Adjacent to OCS/ESZ and adjacent to SWS1, Option 1	Proposed Project is not located in plan area, but in adjacent Samtrans-owned land. Would not require any reconfiguration of land uses. May increase chance of commercial/light industrial near tracks, but will not preclude residential.
77	City and County of San Francisco	Mission Bay Redevelopment Plan	**Construction:** Adjacent. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Much completed but development will continue in following decades	Adjacent to OCS/ESZ	Plan designates rail ROW for public use including rail uses. PCEP is consistent with plan.
78	City and County of San Francisco	Visitacion Valley/Schlage Lock Plan	**Construction:** Adjacent. Air Quality; Cultural Resources; Geology & Soils; GHG emissions; Hazards and Hazardous Materials; Hydrology and Water Quality, Noise, Public Services and Utilities; Transportation and Traffic. **Operations:** Aesthetics, Air Quality; GHG emissions; Hydrology & Water Quality; Land Use and Recreation; Noise and Vibration; Public Services and Utilities; Transportation and Traffic.	Next 10 to 20 years	Adjacent to OCS/ESZ and adjacent to PS2	Plan covers area around Bayshore Station and designated residential on Schlage Lock site next to JPB ROW (project helps residential by reducing diesel emissions/noise). PS-2 adjacent to light industrial designated area on UPRR land that may also be park or light industrial. PS-2 would not be inconsistent with plan designations of adjacent area.

[a] The 1.0 mile distance corresponds to the San Jose Airport – VTA Connector PRT System Project. The Caltrain ROW is 1.0 mile from Mineta San Jose International Airport.

Sources: ABAG and MTC. 2013a; ABAG and MTC, No date; BART 2013; Brisbane Baylands 2010; LTK 2013; Caltrain 2013a; Caltrain 2013b; Caltrans 2013; CCJPA 2013; CHSRA 2012a; CHSRA 2012b; CHSRA 2012c; CHSRA 2012d; CHSRA 2012e; CHSRA 2010a; CHSRA 2010b; CHSRA 2010c; CHSRA 2010d; CHSRA 2010e; CHSRA/City of San Jose 2012; City of Brisbane 2013; City of Brisbane 2005; City of Burlingame; 2013; City of Menlo Park 2013a; City of Menlo Park 2013b; City of Menlo Park 2013c; City of Menlo Park 2013d; City of Mountain View 2012; City of Mountain View 2009; City of Palo Alto 2013a; City of Palo Alto 2013b; City of Palo Alto 2013c; City of Palo Alto 2012; City of Redwood City 2013a; City of Redwood City 2013e; City of San Carlos 2012; City of San Francisco 2012; City of San Jose 2013a; City of San Jose 2013b; City of San Jose 2013c; City of San Jose 2012; City of San Mateo 2013a; City of San Mateo 2013b; City of San Mateo 2013c; City of San Mateo 2013d; City of San Mateo 2013e; City of San Mateo 2013f; City of San Mateo 2013g; City of Sunnyvale 2013; Civil Engineering Associates 2007; Grand Boulevard Initiative. 2012; ICF International 2012; Lamphier-Gregory 2011; LSA Associates 2007; LTK 2012; PFRUG 2013; Richmond Mining Limited, undated; Richmond Mining Limited 2010; SFMTA 2013; SJRRC 2013; VTA 2010; TJPA 2004 and subsequent; Greenway, Greg. Pers. Comm.

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4.1.3.1 Rail Projects Planned within the Caltrain Corridor

High-Speed Rail Blended Service from San Jose to San Francisco

Blended service will include a number of different actions by different parties. The CHSRA is responsible for high-speed rail service planning. The TJPA is responsible for the Transbay Transit Center and Downtown Extension which would serve both Caltrain and HSR, in addition to other transit providers at the TTC. The JPB is responsible for Caltrain electrification to Fourth and King and ultimately for Caltrain service to TTC once DTX and TTC are completed. Both HSR blended service and the TTC/DTX project are discussed together below for the ease of reader review of blended service improvements overall.

~~This project~~ HSR Blended Service is Project #1a on Table 4-3 and in Figure 4-1.

The CHSRA previously prepared a final program-level environmental analysis of a statewide HSR system (CHSRA 2005). The program-level analysis included an evaluation of various alignments for high-speed service. In 2008, the CHSRA issued a final program-level environmental analysis of the Bay Area to Central Valley alignments. This analysis identified the Pacheco Pass and the Caltrain alignment as its preferred alternative. There were several legal challenges to the final program-level environmental analysis of the environmental analysis for the Bay Area to Central Valley alignments that resulted in court orders to make certain revisions to the Final Program EIR. Revisions to the Final Program EIR were completed in 2010 and 2012. Subsequent to certification of the 2012 revisions, the CHSRA confirmed that the selected route for the California HSR system is the Pacheco Pass alignment from the Central Valley to the Bay Area and the Caltrain corridor for the Bay Area segment from San Jose to San Francisco.

In 2009, CHSRA began project-level analysis of a grade-separated, four-track system from San Jose to San Francisco, including an alternatives analysis and a supplemental alternatives analysis. The four-track proposals by CHSRA were controversial along the Peninsula corridor, with a diversity of opinions about the project. Taking into account these concerns, CHSRA decided in 2012 to change its approach for the Peninsula corridor and embrace a Blended Service concept in which Caltrain and CHSRA would share operations on the corridor and CHSRA would primarily be located within the Caltrain right of way (CHSRA 2012a).

Blended Service would consist of electrified Caltrain trains[3] and HSR trains mostly using the same tracks from San Francisco to San Jose, with a section of passing tracks for scenarios with up to four HSR trains per peak hour per direction (pphpd). There would be no Blended Service south of Santa Clara. Caltrain and CHSRA have engaged in planning level studies of Blended Service to demonstrate its viability. The details of Blended Service are not available at this time. Additional planning and design will be done later and evaluated in a separate environmental evaluation of Blended Service by the CHSRA. For purposes of this cumulative analysis, two representative Blended Service scenarios are considered: the "6-2" scenario and the "6-4" scenario:

[3] The Peninsula Corridor Electrification Project would replace approximately 75 percent of the revenue service fleet with EMUs for service from San Francisco to San Jose. Additional funding would need to be secured beyond that available for the Proposed Project to provide sufficient rolling stock to have 100 percent electrified service from San Francisco to San Jose. Diesel service would continue from Gilroy to San Jose under all scenarios.

- Under the "6-2" scenario, up to two HSR trains pphpd in addition to the six Caltrain trains pphpd planned under the Proposed Project has been analyzed by Caltrain. This scenario would not require passing tracks.
- Under the "6-4" scenario, up to four HSR trains pphpd in addition to six Caltrain trains pphpd planned under the Proposed Project has been analyzed by Caltrain. This scenario would require one section of passing track (see discussion below).

Additional "Core Capacity" projects (as described in the nine-party MOU[4] for the *High Speed Rail Early Investment Strategy For a Blended System in the San Francisco to San Jose Segment Known as the Peninsula Corridor of the Statewide High-Speed Rail System*) including needed upgrades to stations, tunnel, bridges, potential passing tracks, other track modifications and rail crossing improvements including selected grade separations will be required to accommodate the mixed traffic capacity requirements of high-speed rail service and commuter services on the Caltrain corridor. However the specific Core Capacity projects have not been identified or defined at this time. These projects would be identified in future discussions and evaluations between CHSRA and Caltrain and other agencies. Core Capacity projects would be subject to separate, project-level environmental evaluation by the implementing agency/agencies.[5]

Table 4-4 presents some key conceptual assumptions that have been studied by Caltrain about Blended Service at this time. These assumptions are used in the cumulative impact analysis in this EIR.

As noted in Table 4-4, the cumulative analysis in this EIR presumes speeds for Blended Service up to 110 mph in light of the following considerations:

- The blended system has been simulated by Caltrain at speeds of up to 110 mph and shows a blended system to be viable.
- The 2012 Partially Revised Program EIR for the Bay Area to Central Valley states the following: "The HST could operate at maximum speeds of 100–125 mph along the Peninsula providing 30-minute express travel times between San Francisco and San Jose." (CHSRA 2012f)
    - CHSRA has confirmed that with speeds up to 110 mph, a 30-minute express travel time can be achieved between San Jose and San Francisco as required by Prop 1A (CHSRA 2013a).
    - If it is determined to be necessary to analyze speeds greater than 110 mph in the future, additional simulations will be performed to understand the viability and implications of the speed range identified by CHSRA in the 2012 Partially Revised Program EIR.
    - If speeds beyond 110 mph are ultimately proposed by CHSRA for the Caltrain corridor, track improvements may be necessary on the route to allow for an increase in top speed as well as any FRA-mandated safety improvements, and they will be evaluated in the separate environmental document for evaluating HST service on the San Francisco Peninsula.

[4] Memorandum of Understanding (MOU). *High Speed Rail Early Investment Strategy for a Blended System in the San Francisco to San Jose Segment known as the Peninsula Corridor of the Statewide High-Speed Rail System.* City and County of San Francisco, San Francisco County Transportation Authority, Transbay Joint Powers Authority, San Mateo County Transportation Authority, Santa Clara Valley Transportation Authority, City of San Jose, and MTC. See discussion in Chapter 1, *Introduction*.

[5] Core Capacity projects do not include DTX/TTC, which is a separate project that has already been reviewed under CEQA and NEPA and TTC is already under construction.

Table 4-4. Key Assumptions in High-Speed Rail Blended Service Conceptual Description

Subject	Assumption	Source
Number of HSR trains (per peak hour per direction)	Up to 4[a]	CHSRA 2012 Business Plan, *Estimating High-Speed Train Operating and Maintenance Cost for the CHSRA 2012 Business Plan* (CHSRA 2012b) CHSRA 2014 *Business Plan Ridership and Revenue Technical Memorandum*, ~~Draft~~ 2014 Business Plan. (CHSRA 2014b)
Number of trains/day for 2040	~~Up to~~ 40 round trips (80 trains) up to 53 round trips (106 trains) [b]	CHSRA 2012 Business Plan, *Estimating High-Speed Train Operating and Maintenance Cost for the CHSRA 2012 Business Plan* (CHSRA 2012b). CHSRA 2014 Business Plan, *Service Planning Methodology*, CHSRA 2014c)
Hours of operation	5 a.m. to 12:30 a.m.	San Francisco to San Jose Preliminary Alternatives Analysis Report Appendix K (CHSRA 2010a)
Study Speeds	Up to 79 mph and up to 110 mph[c]	*Caltrain/California HSR Blended Operations Analysis* (LTK 2012)
Ridership Forecasts	See Table 4-5	
Merging HSR tracks from Diridon to Santa Clara	Two tracks from San Jose Diridon Station to Santa Clara Station	Conceptual locations described in *Caltrain/California HSR Blended Operations Analysis* (LTK 2012) and *Caltrain/HSR Blended Service Plan Operations Considerations Analysis* (LTK 2013)
Potential number of passing tracks	One location (see description in text)	Same as above.
Storage yards and maintenance facilities	Specific location(s) not known (see text discussion)	*Caltrain/HSR Blended Service Plan Operations Considerations Analysis* (LTK 2013)
HSR Station Descriptions	Transbay ~~Terminal~~ Transit Center (San Francisco)	Transbay Transit Center Program Final SEIS/EIR (2004) and subsequent addenda. (TJPA 2004 and subsequent)
	4th and King Interim Station (San Francisco), if necessary	CHSRA 2014 comment letter on the PCEP DEIR (see Volume II)
	Millbrae	San Francisco to San Jose Supplemental Alternatives Analysis Report (CHSRA 2010b).
	Redwood City (to be determined)	California High-Speed Rail Program Revised 2012 Business Plan: Building California's Future (CHSRA 2012a)

Subject	Assumption	Source
	San Jose Diridon	San Francisco to San Jose Supplemental Alternatives Analysis Report (CHSRA 2010b) San Jose Visual Design Guidelines (CHSRA/City of San Jose 2012) San Jose to Merced Preliminary Alternatives Analysis (CHSRA 2010e)
Planned grade separations	Center Street (if Millbrae Station constructed as in SF–SJ Supplemental Alternatives Analysis Report) Other grade separations[d] (to be determined)	San Francisco to San Jose Supplemental Alternatives Analysis Report (CHSRA 2010b)

Notes:

[a] The ~~CHSRA 2012 Revised Business Plan *Ridership and Revenue Forecasting* (CHSRA 2012c) and the Draft~~ 2014 Business Plan *Ridership and Revenue Technical Memorandum*, (CHSRA 2014b) presume<u>s</u> Phase 1 Blended Service would have up to four trains per peak hour and up to four trains per off-peak hour. This EIR presumes up to 40 <u>to 53</u> daily round-trip high-speed trains in 2040 based on the CHSRA 2012 Business Plan, *Estimating High-Speed Train Operating and Maintenance Cost for the CHSRA 2012 Business Plan* (CHSRA 2012b) <u>which assumed 40 round-trip trains per day and the CHSRA 2014 Business Plan Service Planning Methodology (CHSRA 2014c) which assumes up to 53 round-trip trains per day. There is no explicit statement in the 2014 Business Plan of the daily number of HSR trains for the San Francisco to San Jose segment.</u> The ~~Draft~~ 2014 Business Plan *Service Planning Methodology* document (CHSRA 2014c) includes an assumption of 53 daily round trip trains starting in 2029 and continuing beyond 2040. Caltrain's Blended Service planning to date<u>. The ridership included in this EIR is based on the latest 2014 CHSRA Business Plan</u> ~~has not studied the 2014 Business Plan estimates because the plan was released on February 7, 2014 and conceptual Blended Service studies were completed in 2012 and 2013. Thus, this Draft EIR is based on the 40 daily round-trip high-speed trains consistent with Blended Service studies completed by Caltrain~~. <u>The exact number of HSR trains along the corridor is unknown.</u> The subsequent CHSRA project-level environmental evaluation will address proposed high-speed train service levels along the San Francisco Peninsula.

[b] As noted in the prior footnote, this ~~Draft~~ EIR presumes 40 <u>to 53</u> daily <u>round-trip</u> high-speed trains up to 2040.

[c] As described in text above, Caltrain has simulated Blended Service operations for speeds up to 79 mph and up to 110 mph and thus this EIR evaluates these two speed scenarios in this cumulative analysis. If it is determined to be necessary to analyze speeds greater than 110 mph in the future, additional simulations will be performed to understand the viability and implications of the 100 to 125 mph speed range identified by CHSRA in the 2012 Partially Revised Program EIR (CHSRA 2012f). If speeds beyond 110 mph are ultimately proposed by CHSRA for the Caltrain corridor, they will be evaluated in the separate environmental document for evaluating HST service on the San Francisco Peninsula.

[d] Blended Service is not defined as a fully grade-separated system. See discussion in text about other potential grade separations.

The blended system will be part of the roughly 540–mile HST system travelling between San Francisco and Los Angeles.

Ridership

HSR ridership has been evaluated by CHSRA for 2030 under low and high ridership scenarios. Table 4-5 shows Blended Service ridership estimates for 2030 under the low and high scenarios for the Peninsula corridor stations. These estimates are for HSR ridership only; no joint HSR/Caltrain service ridership modeling has been completed. No estimate of blended system ridership with a Redwood City HSR station was included in the *2012 Revised Business Plan* (CHSRA 2012a) or the Draft *2014 Business Plan* (CHSRA 2014a). For the purposes of this EIR, all HSR ridership is assumed to be in addition to Caltrain ridership to analyze maximum potential traffic and other impacts due to increased ridership at combined HSR/Caltrain stations.

CHSRA released its Draft *2014 Business Plan* (CHSRA 2014a) in early February 2014 which presents higher ridership estimates than in the *2012 Revised Business Plan*; these estimates, which were draft at the time of the Draft EIR, have since been finalized and are shown in ~~These estimates are provided in~~ Table 4-5 below.

Table 4-5. Projected Blended Service High-Speed Rail 2029/2030 Weekday Daily Boardings at Peninsula Corridor Stations without Optional Redwood City HSR Station

Station	*Revised 2012 Business Plan* (CHSRA 2012c)		~~Draft~~ Final *2014 Business Plan* (CHSRA 2014a)	
	2030-Low Scenario	2030-High Scenario	2029 -Phase 1 Blended	2040 – Phase 1 Blended
San Francisco (TTC)	11,500	20,500	15,400	19,700
Millbrae	2,600	4,200	6,900	8,500
San Jose	3,300	6,100	8,200	10,200
Note: This table reports boardings, not boardings plus alightings				

Station Improvements

Station design is at a preliminary conceptual level except for the Transbay Transit Center (TTC). The concepts for station improvements at San Francisco (TTC), Millbrae, Redwood City, and San Jose Diridon Stations to accommodate HSR/Caltrain Blended Service are described below.

San Francisco Transbay Transit Center (TTC) and Downtown ~~Rail~~ Extension (DTX)

This is Project 1b in Table 4-3. The Transbay Joint Powers Authority (TJPA), consisting of the City and County of San Francisco, the State of California, Alameda-Contra Costa Transit District, the JPB, and Caltrans (ex officio) is leading the planning and implementation of the TTC and Downtown ~~Rail~~ Extension (DTX) projects.

The TTC/DTX is an independent project with multiple purposes of supporting Caltrain extension to downtown, improved transit services and coordination, as well as facilitating future high-speed rail service to the TTC. However, because it is an integral part of Blended Service, it is discussed in concert with the discussion of blended service.

A Final EIS/EIR for the DTX and TTC projects and the related redevelopment project (collectively, the Transbay Program) was completed in 2004. A number of addenda have been completed since 2004. TJPA is presently preparing a Supplemental EIS/EIR for certain changes to the Transbay Program as noted below.

The Transbay Program consists of three components.

- A new, multi-modal transportation facility (the TTC) at the site of the former Transbay Terminal at First and Mission Streets, which is currently under construction.
- A 1.3 ~~2~~-mile extension (the DTX) of Caltrain commuter rail service from its current San Francisco terminus at 4th and King Streets to the new TTC.
- Development of a mix of new and transit-oriented uses on publicly-owned property in the vicinity of the new TTC, including an estimated 3,000 new homes and mixed-use commercial development.

Other features analyzed in the 2004 Final EIS/EIR are an off-site bus storage facility, new bus ramps connecting to the Bay Bridge, a temporary bus facility for use during the construction of the TTC, and a reconfigured Caltrain layover yard. The new TTC has also been designed to serve the proposed HSR system. As part of the DTX project, the track between Caltrain's existing 4th and King Street terminal and the new downtown terminal would be electrified.

Phase 1 of the project consists of the TTC and is presently under construction with expected completion in approximately 2017.

Phase 2 consists of the 1.3 ~~2~~-mile extension of Caltrain service to the TTC from the existing Caltrain terminal at Fourth and King Street. The Supplemental EIS/EIR currently being prepared by TJPA will analyze proposed modifications to Phase 2, including the DTX track curvature entering the TTC, extension of platform rail levels to accommodate HSR requirements, an intercity bus facility, vent shaft enlargements and other minor refinements. The DTX work is on hold due to a funding gap and, thus, it appears likely that DTX will be completed after the Proposed Project. Scheduling is depending on funding availability.

The prolonged delay of the DTX may require an interim high-speed rail terminal station at the 4th and King Station. As necessary, the CHSRA would evaluate this interim terminal station in a subsequent, project-level environmental impact analysis and document.

The critical aspects for Blended Service are as follows:

- HSR service (up to four trains pphpd) would terminate or originate at the TTC with multiple dedicated platforms.
- The new line between the 4th and King Caltrain Station and TTC would be electrified as part of the DTX project.
- Caltrain service, once electrified, would extend to the TTC with the completion of the DTX. In concept, Caltrain service has been studied with split service between the 4th and King Caltrain Station and TTC, with some trains terminating at each station.

San Francisco 4th and King Station and Approach

Based on current planning, the HSR service would not stop at either the San Francisco 4th and King Caltrain Station or the future 4th and Townsend underground station (unless, as noted above, DTX

is delayed beyond the point that interim HSR service to 4th and King is possible in which case an interim terminal would operate at 4th and King). It would continue underground through the 4th and Townsend Station to the TTC. The surface station at 4th and King would be for Caltrain service terminating at that point. The underground 4th and Townsend Station would be a stop for Caltrain service terminating at the TTC. The platforms of the two stations would be connected vertically by stairs, escalators, and elevators to an underground mezzanine.

Pursuant to current DTX designs, DTX tracks would begin just north of 16th Street with new tracks and sidings as the alignment approaches the 4th and Townsend and the 4th and King Stations. The surface tracks and underground tracks would separate at approximately Berry Street.[6]

The Proposed Project would electrify the 4th and King Station and yard, including the existing six platforms and 12 tracks. This would allow for electrified operations to start in 2020 ~~2019~~. At present, the Proposed Project does not include funding to reconfigure the station and yard.

The station configuration at the Fourth and King Station assumed ~~covered~~ in the TJPA 2004 EIS/EIR ~~and approved by the TJPA would reconstruct the storage yard with~~ included three surface platforms and six tracks on the southern portion of the existing facility and ~~add~~ a new one-platform underground station on the northern portion near Townsend and Fourth Street. TJPA indicated in its comment on the PCEP Draft EIR that full platform reconfiguration is not part of DTX. Although the station reconfiguration was assumed in the original 2004 EIS/EIR project description, TJPA clarified that full platform reconfiguration is assumed to be a separate project by others. A potential future project (currently unfunded) to reconfigure the 4th and King platforms is described separately below under discussion of Caltrain projects.

The schedule for completion of the DTX has not yet been determined and funding for platform reconfiguration is uncertain at this time, thus, it is possible that station reconfiguration, if appropriate, will occur sometime after 2020 ~~2019~~, when funding is available. Should funding become available prior to 2020 ~~2019~~, it may be possible to reconfigure the station and yard prior to electrification.

Millbrae Station

The most recent design for a HSR station at Millbrae was presented in the 2010 HSR Alternatives Analysis for the Peninsula corridor and would include two dedicated HSR tracks and platforms at-grade. The Caltrain station would be split level with one platform at-grade and one below-grade (CHSRA 2010c). A grade separation at Center Street in Millbrae would be necessary because of the changes at the Millbrae Station (CHSRA 2010a). The station design will need to be reevaluated to ensure appropriate scale for the blended system.

Redwood City Station

No decision has been made by CHSRA or Caltrain or any other party that there will be a Redwood City Station. Based on the designs in the 2010 HSR Alternatives Analysis, the Redwood City Station could be either elevated or below-grade in a trench. If there is a Redwood City HSR station that is elevated or below-grade, then there would also be grade separations at the nearby street crossings (CHSRA 2010a). The station design will need to be reevaluated to ensure appropriate scale for the blended system.

[6] The Mission Bay Drive crossing would remain at-grade based on current designs.

San Jose Diridon Station

The San Jose Diridon Station would have dedicated platforms for HSR. The design of the station improvements has been the subject of prior and ongoing study. CHSRA is currently in the process of refining design alternatives for the HSR alignment through San José. These alternatives will be evaluated by the CHSRA when they prepare the San José to Merced and/or San Francisco to San José HSR EIR/EIS documents.

At present, potential designs for the San Jose Diridon Station show either an elevated or a below-grade station. Depending on the vertical placement of the station, the approaches from the south and the north to the station could be in a tunnel or on an aerial structure. The approaches would likely transition from two tracks to four tracks as they approach the station to allow for four tracks in the station (CHSRA 2010a, 2010b, 2010e).

Additional Trackage

Merging HSR Tracks from Diridon to Santa Clara

Blended Service would include two new dedicated HSR tracks between the San Jose Diridon Station and just north of the Santa Clara Caltrain Station (CHSRA 2010b). The dedicated tracks would proceed northward on either an aerial structure or in a tunnel from the San Jose Diridon Station and merge into middle of the Caltrain mainline at grade north of Control Point (CP) De La Cruz which is just north of the Caltrain Santa Clara Station (CHSRA 2010b).

Passing Tracks

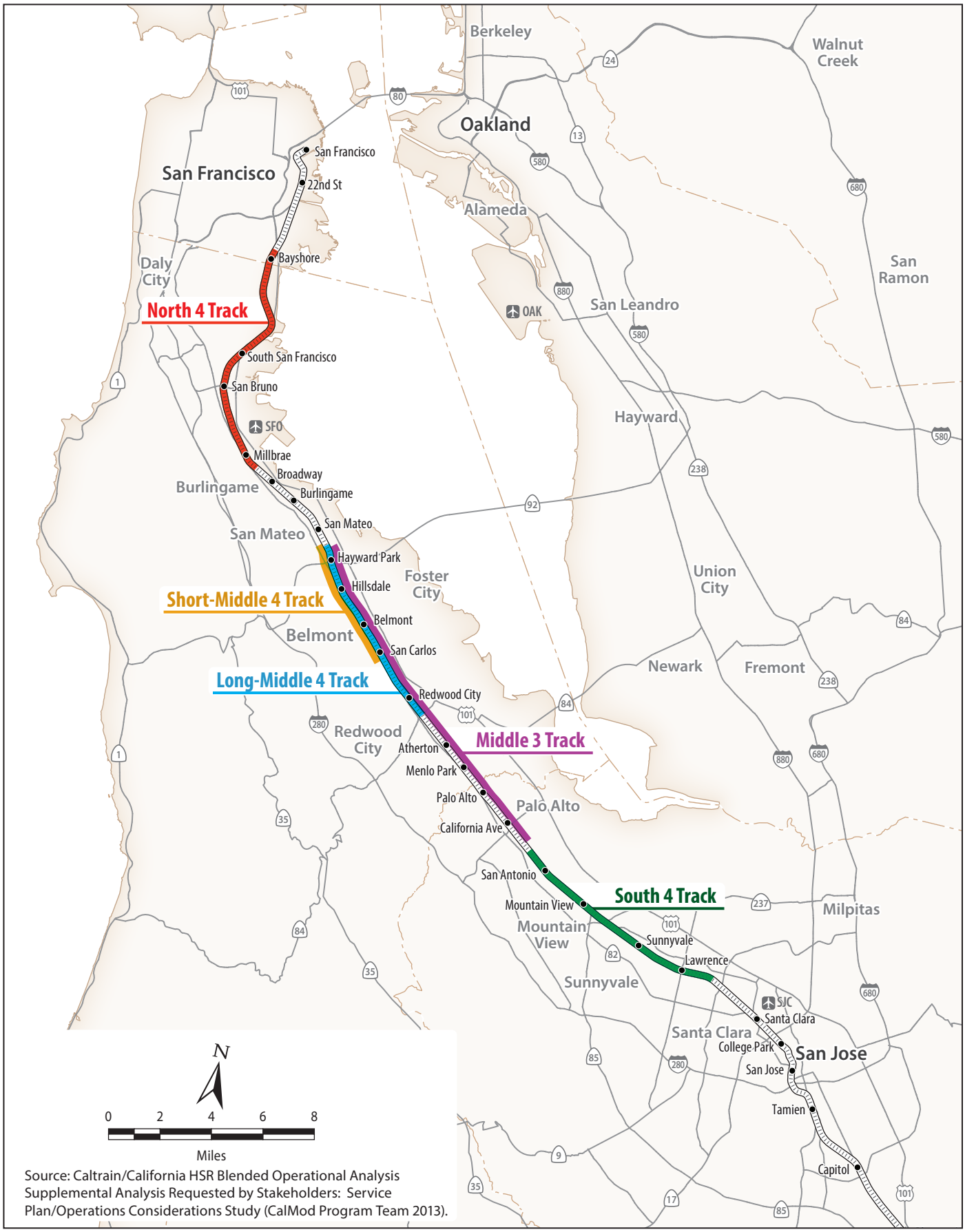
As described above, the "6-4" scenario would require passing tracks. It is important to note that no decisions have been made about the locations of passing tracks; the subsequent design and environmental process will define the actual proposed passing track locations. The locations studied to date are identified to support a "proof of concept" approach only. Proposed passing track locations could include other variations than those studied to date. However, because the locations analyzed in the capacity studies completed to date are the only locations that have been studied, these locations are used in this EIR to disclose at a very general level what the impacts of passing tracks may be with Blended Service.

Passing tracks would be added to the existing tracks in limited segments of the corridor to be used by HSR trains to bypass Caltrain trains stopping at stations. The conceptual information used in this EIR about passing tracks comes from two planning studies completed in 2012 and 2013.

- Caltrain/California HSR Blended Operations Analysis (LTK 2012).
- Caltrain/California HSR Blended Operational Analysis Supplemental Analysis Requested by Stakeholders: Service Plan/Operations Considerations Study (LTK 2013).

Passing tracks required for operational overtakes (i.e., one same-direction train passing another) would improve the integration of Caltrain and HSR services, avoid either service being substantially delayed at a passing track location by the other service, and are required to support the "6/4" scenario. The operational studies completed by Caltrain (LTK 2012; LTK 2013) provide further information on the overtake's operational requirements; the reader is referred to those studies for further detail.

Five potential overtake locations have been conceptually defined and are shown in Figure 4-2.:



Source: Caltrain/California HSR Blended Operational Analysis Supplemental Analysis Requested by Stakeholders: Service Plan/Operations Considerations Study (CalMod Program Team 2013).

Graphics ... 00606.12 (1-27-14)

Figure 4-2
Potential Passing Track Locations Studied to Date
Peninsula Corridor Electrification Project

- The North 4-Track:
  - 10.2-mile-long, 4-track segment of tracks from milepost (MP) 5 (San Francisco) to MP 15.2 (Burlingame), including existing four-track configuration at Bayshore Station.
  - Includes four Caltrain stations: Bayshore, South San Francisco, San Bruno, and Millbrae.
  - Includes one HSR station: Millbrae.
- The Long-Middle 4-Track:
  - 9.1-mile-long, 4-track segment of tracks from MP 18.1 (San Mateo) to MP 27.2 (south part of Redwood City), including existing 4-track configuration south of Redwood City.
  - Includes five Caltrain stations: Hayward Park, Hillsdale, Belmont, San Carlos, and Redwood City.
- The Short-Middle 4-Track:
  - 6.1-mile-long, 4-track segment of tracks from MP 18.1 (San Mateo) to MP 24.2 (San Carlos).
  - Includes four Caltrain stations: Hayward Park, Hillsdale, Belmont, and San Carlos.
- The Middle 3-Track:
  - 15.6-mile-long, 3-track segment of tracks from MP 18.1 (San Mateo) to MP 33.7 (southern part of Palo Alto)
  - Includes ten Caltrain stations: Hayward Park, Hillsdale, Belmont, San Carlos, Redwood City, Atherton, Menlo Park, Palo Alto, Stanford, and California Avenue.
- The South 4-Track:
  - 7.8-mile-long, 4-track segment of tracks from MP 33.8 (Mountain View) to MP 41.6 (Santa Clara south of Lawrence Station), including existing 4-track configuration at Lawrence Station.
  - Includes four Caltrain stations: San Antonio, Mountain View, Sunnyvale and Lawrence.

The four-track overtake options allow two dedicated tracks for HSR for a limited segment of the corridor—one track per direction. The three-track overtake option allows one dedicated track for HSR for a limited segment of the corridor—one track that must be shared in both directions. One-half of the three-track overtake supports northbound trains and the other half supports southbound trains.

The operational studies completed by Caltrain (LTK 2012; LTK 2013) evaluated HSR and Caltrain performance of different passing tracks options; the reader is referred to those studies for details. Those operational studies are incorporated by reference into this EIR.

Other Trackage Improvements

At present the Caltrain corridor is rated for speeds of up to 79 mph. Blended Service at speeds greater than 79 mph up to 110 mph will require additional track improvements that could include upgrades of tracks, trackbeds, ties, interlockings as well as possible curve realignments and other

improvements.[7] Potential improvements have not been identified at this time but would be identified as part of subsequent Blended Service design.

CHSRA Storage Yards and Maintenance Facilities

When the four-track, fully grade-separated HSR system was contemplated in the Peninsula corridor, a storage/maintenance facility of approximately 100 acres was contemplated at several locations, including San Francisco, Brisbane/Bayshore, San Francisco International Airport and Santa Clara. The Brisbane/Bayshore site was described as the most feasible (CHSRA 2010a).

Given that Caltrain and CHSRA are now committed to a blended system on the Peninsula, previous assumptions for HSR operations and maintenance facilities have changed. The CHSRA will be re-evaluating the Peninsula for site-specific and operationally feasible locations that would meet the needs for maintenance and storage of high speed train sets. Suitable potential sites will be identified and evaluated through the blended system environmental process, a later process that is separate and distinct from this EIR.

Grade Crossing Improvements/Grade Separations

Apart from the grade separation assumed in the 2010 HSR Alternatives Analysis at Center Street in Millbrae and the grade separations that would be necessary for the HSR aerial section from San Jose Diridon Station to north of the Santa Clara Caltrain Station (described previously above), no decisions have been made regarding the potential additional at-grade crossing improvements or grade separations necessary for Blended Service. To date, Blended Service has been defined as a partially grade-separated system, not a fully grade-separated system.

FRA's regulatory requirements for at-grade crossings greater than 79 mph are as follows (FRA 2014):

- For 110 mph or less: At-grade crossings are permitted. States and railroads cooperate to determine the needed warning devices, including passive crossbucks, flashing lights, two quadrant gates (close only "entering"' lanes of road), long gate arms, median barriers, and various combinations. Lights and/or gates are activated by circuits wired to the track (track circuits).
- For 110 to 125 mph: FRA permits crossings only if an "impenetrable barrier" blocks highway traffic when train approaches.
- Above 125 mph: No at-grade crossings permitted.

As noted above, at this time, Caltrain has only studied Blended Service operations up to 110 mph which have been shown to meet Prop 1A required timeframes for HSR service. For speeds greater than 79 mph up to 110 mph, there may be a need for additional at-grade crossing improvements; specific improvements would need to be identified during subsequent Blended Service design.

Additional grade separations may also be desirable for operational purposes. Further, when combining HSR service with Caltrain and other tenant railroads, cumulative localized traffic and

[7] As described above, Caltrain has evaluated Blended Service for speeds up to 79 mph and up to 110 mph; thus these two scenarios are evaluated in this EIR. Any consideration of speeds in excess of 110 mph would need to be evaluated in subsequent Blended Service design for viability and evaluated in the separate environmental evaluation by CHSRA for Blended Service.

noise impacts are likely at many locations along the corridor and grade separations at some locations may be considered in the environmental analysis for Blended Service as mitigation.

The separate environmental process for the Blended Service will need to analyze all impacts related to Blended Service including noise and traffic impacts related to increased train trips along the Caltrain corridor as well as the impacts of any proposed passing tracks and any proposed at-grade crossing or grade-separation improvements.

Other Core Capacity Projects

In addition to the improvements described above concerning stations, passing tracks, other track improvements and grade separations, there will be additional Core Capacity projects including improvements to tunnels and bridges or other improvements needed to accommodate mixed traffic capacity requirements of HSR service and Caltrain commuter rail service. These other projects would be identified as part of subsequent Blended Service design and would be evaluated in the separate environmental document prepared by CHSRA.

Trackage Rights

Union Pacific owns intercity passenger rail rights along the Caltrain Corridor. While the PCEP does not propose intercity rail, HSR service would be intercity rail. The TRA between the PCJPB and Union Pacific contemplates that additional parties may seek to share the right of way to provide intercity passenger service and requires the parties to negotiate with such third parties in good faith (Section 2.7(b)). According to the 2014 Business Plan, CHSRA does propose to use the Caltrain Corridor as part of future blended service. If high-speed intercity rail operations are to occur along the Caltrain corridor, then CHSRA would need to obtain intercity passenger rail rights from Union Pacific. Given that current CHSRA plans are to operate in the Caltrain Corridor, it is appropriate that the PCEP EIR conceptually analyze blended service operations in the Caltrain Corridor.[8]

Schedule

Based on the CHSRA *Revised 2012 Business Plan* (and the Draft *2014 Business Plan*), HSR service could be extended to San Jose by 2026 and to San Francisco by sometime between 2026 and 2029. It is possible, but unknown at this time, that San Jose Diridon would serve as a temporary northern terminus for the HSR system between the time service is provided to San Jose and the time that service is provided to San Francisco.

As noted above, while TTC is under construction, the exact timing for the DTX and Core Capacity projects is not known at present.

[8] If CHSRA is not able to obtain the intercity passenger rights to operate in the Caltrain Corridor, then there would be no blended service on the tracks that Caltrain shares with freight today. In concept, CHSRA would then be required to operate on separate tracks from those covered by the TRA, which may have different environmental impacts than the proposed blended service. This issue is more appropriately addressed in the project-level environmental analysis of high-speed rail operations on the Caltrain Corridor. It would be highly speculative for the JPB to analyze an alternative high-speed rail system for the corridor that has neither been designed nor is proposed by CHSRA at this time in the cumulative analysis for the PCEP EIR. The JPB has analyzed cumulative impacts based on the current concept for blended service by CHSRA (as well as the other cumulative projects) at this time; if any subsequent change in the blended service concept is ultimately considered, any resulting impacts are best addressed in the separate environmental review process for blended service.

San Francisco Transbay Transit Center (TTC) and Downtown ~~Rail~~ Extension (DTX)

This project is Project #1b on Table 4-3 and in Figure 4-1.

The Transbay Joint Powers Authority (TJPA), consisting of the City and County of San Francisco, the State of California, Alameda-Contra Costa Transit District, the JPB, and Caltrans (ex officio) is leading the planning and implementation of the TTC and Downtown ~~Rail~~ Extension (DTX) projects.

A Final EIS/EIR for the DTX and TTC projects and the related redevelopment project (collectively, the Transbay Program) was completed in 2004. A number of addenda have been completed since 2004. TJPA is presently preparing a Supplemental EIS/EIR for certain changes to the Transbay Program.

The Transbay Program consists of three components.

- A new, multi-modal transportation facility (the TTC) at the site of the former Transbay Terminal at First and Mission Streets, which is currently under construction.
- An approximately 1.3-mile extension (the DTX) of Caltrain commuter rail service from its current San Francisco terminus at 4th and King Streets to the new TTC and a new underground Caltrain station at 4th and Townsend.
- Development of a mix of new and transit-oriented uses on publicly-owned property in the vicinity of the new TTC, including an estimated 3,000 new homes and mixed-use commercial development.

Other features analyzed in the 2004 Final EIS/EIR are an off-site bus storage facility, new bus ramps connecting to the Bay Bridge, a temporary bus facility for use during the construction of the TTC, and a reconfigured Caltrain layover yard. The new TTC has also been designed to serve the proposed HSR system. As part of the DTX project, the track between Caltrain's existing 4th and King Street terminal and the new downtown terminal would be electrified.

Phase 1 of the project consists of the TTC and is presently under construction with expected completion in approximately 2017.

Phase 2 consists of the 1.3-mile extension of Caltrain service to the TTC from the existing Caltrain terminal at Fourth and King Street.

A Supplemental EIS/EIR currently being prepared by TJPA will analyze proposed modifications to Phase 2, including the DTX track curvature entering the TTC, extension of platform rail levels to accommodate HSR requirements, an intercity bus facility, vent shaft enlargements and other minor refinements. The DTX work is on hold due to a funding gap and, thus, it appears likely that DTX will be completed after the Proposed Project. Scheduling is depending on funding availability.

California High-Speed Rail San Jose to Merced (as part of Phase 1 Blended System)

This is project number 2 in Table 4-3 and Figure 4-1.

The San Jose to Merced section of the California HSR system is a 125-mile corridor running from the Diridon Station in Downtown San Jose to Merced, where the system would connect to the Central

Valley section (Merced to Fresno).[9] From the Diridon Station in San Jose, trains in the San Jose to Merced section would travel south to Gilroy, east through the Pacheco Pass, and then to Chowchilla before turning north to Merced.

San Jose to Merced will be the linkage between San Francisco/San Jose corridor and the Central Valley portion of the HST system and upon completion would be part of the 540-mile Phase 1 Blended System.

The proposed stations are Diridon Station in San Jose, a station in Gilroy, and a downtown Merced station. The San Jose to Merced section of the California HSR system would overlap with the Proposed Project at Diridon Station in San Jose. Capital costs for the San Jose to Merced section are estimated to be $5.4 billion dollars. The purpose of this project and the entire California HSR System is to provide a new mode of high-speed intercity travel that would link major metropolitan areas of the state and provide added capacity to meet increases in intercity travel demand in California.

Environmental review for the San Jose to Merced section began in 2009 and a Draft EIS/EIR is currently being developed. A Preliminary Alternatives Analysis was prepared in 2010 and a Supplemental Alternatives Analysis Report, which evaluated potential route alignments that will be considered in the Draft EIR/EIS, was prepared in 2011. The Preliminary Alternatives Analysis (CHSRA 2010X) evaluated multiple options for the San Jose Approach subsection and recommended the SR 87/I-280 Alignment Alternative. This alignment would be on an aerial structure heading southward from the Diridon Station along the Caltrain ROW to approximately Park Avenue and then would depart from the Caltrain ROW to cross the I-280/SR 87 interchange and then come parallel to the Caltrain ROW next to the Tamien Station. For the Monterey Highway subsection, the alignment would continue south from the Tamien Station along the Caltrain ROW on an aerial structure to Almaden Road, then be an at-grade section from Almaden Road to near Pullman Way and transition back to an aerial structure from near Pullman Way to just north of the Capitol Expressway. While the San Jose to Merced section proceeds further south, the project limits for the Caltrain Peninsula Corridor Electrification Project end just south of Pullman Way. Unlike the Blended Service, there would be no shared track between Caltrain and HSR for the HSR San Jose to Merced segment as HSR would have dedicated tracks.

The San Jose to Merced HSR Project EIR/EIS will tier from the Final Statewide Programs EIR/EIS and the Final Bay Area to Central Valley HSR EIR/EIS. Service is planned to commence along this segment in 2026.

Caltrain Projects

Future Full Electrified (San Francisco to San Jose)

This is project number 3 in Table 4-3 and Figure 4-1.

As described in Chapter 2, *Project Description*, the Proposed Project budget of $440 million for rolling stock would provide for electrification of approximately 75 percent of the revenue service fleet from San Francisco to San Jose. It is the JPB's long-term plan to fully electrify the service from San Francisco to San Jose for the same reasons supporting the Proposed Project. In addition, to accommodate Blended Service (as described above), the Caltrain service between San Jose and San

[9] North of San Jose, the California High-Speed Rail system would connect to San Francisco through Blended Service, discussed above.

Francisco must be fully electrified. The Proposed Project would install the electrical infrastructure necessary to support a fully electrified service, but Caltrain would need to purchase additional EMU rolling stock to support this service.

As shown in Table 4-6, full electrification would require approximately 40 to 50 additional EMU vehicles. Based on the 2009 estimated budget of $440 million for 96 EMUs, the additional EMUs could require an additional $193 to $248 million in funding that has not been secured at this time. As funding becomes available, the JPB intends to replace retiring diesel locomotives with EMUs. If Blended Service is realized by sometime between 2026 and 2029, Caltrain would need to be fully electrified at that time to maintain the levels of service called for in the Proposed Project.

Table 4-6. Fleet Requirements of the Peninsula Corridor Electrification Project (2020 ~~2019~~) and a Future Fully Electrified Service (San Jose – San Francisco)

Year	Diesel Locomotives	EMUs	Diesel-Hauled Vehicles	Total Vehicles
2020 ~~2019~~[a] (Six trains per peak hour/direction)	9	96	45	150
2040[b] (Six trains per peak hour/direction)	6	138 to 150	31	175 to 187

[a] The majority of vehicles would be replaced by 2020 ~~in 2019~~ as they reach the end of their design life. Additional vehicles would be replaced after 2020 ~~2019~~ as they reach the end of their design life.

[b] Diesel operation limited to San Jose–Gilroy shuttle service. 2040 EMU estimate is a conceptual estimate.

Caltrain South Terminal Project

This is project number 4 in Table 4-3 and Figure 4-1.

The South Terminal Project is a multi-phased project to improve the South Terminal Area (STA) portion of the Caltrain corridor between Santa Clara and San Jose to adequately accommodate potential future rail traffic levels. Where constraints with existing infrastructure are identified, improvements are recommended to address the operational needs of Caltrain and its tenants: Altamont Commuter Express (ACE), Capitol Corridor, and Amtrak Long Distance Coast Starlight service. Phase 1 of the project is already complete. Table 4-7 summarizes Phase II and Phase III of the South Terminal Project

Table 4-7. Projects Identified as Improvements to South Terminal Area

Segment	Improvement
CP Shark to CP Alameda[a]	South Terminal Phase II—Fourth main track, CEMOF to Diridon. This additional fourth track would be approximately 2,000 feet long and would require minor right of way acquisition. To incorporate the 4th track, the existing track systems would require rearrangement. Associated signal control work would be included.
CP Bird to Tamien Station	South Terminal Phase III— This project includes the construction of an additional track south of the South Terminal, between the San Jose Diridon Station and the I-280 crossing. Additionally, associated signal work is included and a new control point would be constructed between the Auzerais Avenue crossing and the I-280 crossing. The Auzerais crossing would be reconstructed. This additional track would be approximately 2,000 feet long and would run across the widened portion of the newly constructed Los Gatos Creek Bridge.

[a] CP Shark and CP Alameda are in San Jose. CP Alameda extends north from Diridon Station to north of Santa Clara street and connects to CP Shark, immediately west of SAP Center in San Jose. CP Shark extends to north of Julian Street.

CEMOF = Central Equipment Maintenance Operations Facility.

CP = control point.

I-280 = Interstate 280.

There are no schedules as of yet for these projects.

San Bruno Grade Separation

This is project number 11 in Table 4-3 and Figure 4-1.

The San Bruno Grade Separation Project, which is currently in construction, will elevate Caltrain tracks above three existing at-grade street crossings at San Bruno, San Mateo, and Angus Avenues to improve safety for pedestrians and motorists, and to help reduce traffic congestion from U.S. Highway 101 in San Bruno. Additionally, a new elevated Caltrain station will be constructed between San Bruno and San Mateo Avenues to replace the existing station at Sylvan Avenue. There will be 201 parking spaces and a "kiss-and-ride" lot.

The project will include three pedestrian underpasses, one near Sylvan Avenue, one at the new station, and one between Euclid Avenue and Walnut Street. The elevated station will have elevators to provide easy access for Caltrain riders. The surrounding streets and sidewalks will be improved, including those at Posy Park. Construction is expected to be completed in April 2014 (Caltrain 2013b).

Caltrain Planned Corridor Improvements

This is project number 12 in Table 4-3 and Figure 4-1.

Caltrain Communications Based Overlay Signal System Positive Train Control

The Caltrain Communications Based Overlay Signal System (CBOSS) Positive Train Control (PTC) Project will provide a new advanced signal system. The project, which is in construction now, involves installation of PTC which is a requirement by the FTA on all commuter and freight

railroads. The project will help eliminate train-to-train collisions and over-speed mistakes and provide additional safety measures for railroad workers. The Caltrain CBOSS PTC Project will meet the federal mandate to implement PTC by 2015 and increase system capacity to allow for future increase in ridership and demand. The project components are compatible with Caltrain's existing diesel-based trains, and will also be compatible with the future Caltrain electric powered fleet. In addition, the Caltrain's CBOSS PTC project is being designed to ensure interoperability with HSR as well as existing passenger and freight tenants (Caltrain 2013).

Other Caltrain Improvements

Caltrain improvements that are being planned other than CBOSS PTC, the Proposed Project, the STA improvements, and the San Bruno project include the following:

- Rehabilitation of the Existing System—long-term repairs, reconstruction, and modernization of the existing tracks, signals, bridges, stations, rolling stock, and other systems.
- Bridge replacements in San Francisco, San Mateo[10] and at Los Gatos Creek.
- The modernization of stations such as removing the hold-out rule.
- At-grade crossing improvements and a system-wide fencing program to improve safety.
- South San Francisco Station Improvement Project, which would remove the holdout rule and improve access to station platforms.
- Station security improvements.

Trackwork rehabilitation improvements consist of the following:

- Replacing jointed rail track with continuous welded rail track.
- At-grade crossing improvements.
- Drainage improvements.

Planned rehabilitation improvements include tunnel rehabilitation, retrofit of existing structures to current seismic safety standards, new bridge decks, and new foundations where needed.

Rehabilitation improvements at stations include the following:

- Station security improvements.
- Provision of 600-foot-long (or longer) side platforms.
- Wide center platforms at selected locations.
    - At the Fourth and King Station, this work could include reconfiguration of the platforms from the current 6 platform, 12-track configuration to a 3 platform, 6-track configuration similar to that originally included in the TJPA 2004 EIS/EIR or some other configuration for a surface terminal. This would require realignment of tracks leading to the platforms as well within the 4th and King Yard. Platform reconfiguration is not currently funded and thus it is unknown if and when this proposal might be advanced.

[10] Bridges are presently being replaced in San Mateo at the East Poplar, East Santa Inez Avenue, Monte Diablo, and Tilton Avenue underpasses. The bridge replacement will be completed by 2016. The bridge replacement project has already been environmentally cleared.

- Improved lighting, shelters, and communications facilities at station waiting area.
- Facilities to meet Americans with Disabilities Act (ADA) requirements.
- Underpasses for pedestrians.
- Inter-track fencing to keep passengers from attempting to cross the tracks.
- Bridge rehabilitation.

Dumbarton Rail Corridor

This is project number 5 in Table 4-3 and Figure 4-1.

The Dumbarton Rail Corridor project will extend rail service between the Redwood City Caltrain Station and the Union City BART Station by reconstructing a 20.5-mile existing rail corridor. The purpose of the Dumbarton Rail Corridor Project is to improve transbay public transportation service and interconnections to reduce roadway congestion, improve travel reliability, improve air quality, and address greenhouse gas reduction goals from transportation and development. In the East Bay, the service would use the Union Pacific Railroad's Centerville Line and Oakland Subdivision to reach Union City. The service would then utilize the Dumbarton Line, including crossing the currently out-of-service Dumbarton Rail Bridge across the San Francisco Bay (located east of the SR 84 highway bridge). The Dumbarton Rail Corridor service would operate on the Caltrain mainline beginning at Redwood Junction in Redwood City, with service continuing north to San Francisco and south to San Jose. The extension will connect to existing public transportation services such as BART, ACE, Amtrak's Capital Corridor, Caltrain, and regional bus service.

The reconstruction of the rail corridor will include track improvements, new moveable rail bridges, new train stations in Menlo Park (Willow Road), at Newark's Dumbarton Transit-Oriented Development area, and adjacent to the Union City BART Station, upgrading the Centerville Station in Fremont, a centralized train signal control system, and a layover yard in the East Bay, among other improvements. Depending on the alternative selected, some of these improvements may be within the Caltrain corridor.

An Alternatives Study was completed in March 2011 and an environmental review of the project was initiated. However, Alameda County Measure B, which would have provided funding, did not pass in November 2013. As a result, the JPB and the Federal Transit Administration (FTA) have placed the project on hold until new funding is identified.

A number of different alternatives have been considered for the Dumbarton Rail Corridor. For the purpose of this EIR, the analysis assumed that six diesel locomotive trains will travel from Union City during the AM peak commute period. Three of these trains will travel to San Francisco and three to San Jose. In the PM peak period, these trains will make the reverse trip from San Francisco and San Jose back to Union City.

ACEforward Program

This is project number 6 in Table 4-3 and Figure 4-1.

The ACEforward Program is an initiative of the San Joaquin Regional Rail Commission (SJRRC) to expand ACE service. The project is intended to improve ACE service between Stockton and San Jose and to extend service to Modesto and Merced. The purpose of the project is to enhance commuter and intercity rail service for riders in the northern San Joaquin Valley and the eastern and southern

parts of the Bay Area. ACE commenced its environmental process for the ACEforward Program in June 2013 and intends to complete an EIR/EIS for the program by 2016.

Infrastructure improvements currently under study by ACE would provide for:

- Operation of a fifth and sixth round trip between Stockton and San Jose by 2018.
- Operation of 10 or more round trips between Stockton and San Jose by approximately 2022.
- Operation of six round trips between Stockton and Merced by approximately 2022.

Within the Caltrain project area, the ACE service operates on the Caltrain ROW between Santa Clara and San Jose. The ACEforward program includes increases of up to six round trips on this segment by 2018 and up to 10 round trips or more by approximately 2022. As noted above, this is one of the projects that depends on the improvements to the south terminal area. Further improvements in the south terminal may be needed and are being studied. Additionally, beyond the south terminal area, the ACEforward Program presumes capital improvements east of the Caltrain corridor at certain locations between Stockton and Santa Clara.

Capitol Corridor Oakland to San Jose, Phase 2

This is project number 7 in Table 4-3 and Figure 4-1.

The Capitol Corridor service is operated by the Capitol Corridor Joint Powers Authority (CCJPA). Initially, the service provided six daily trains between Sacramento and San Jose. Between 2002 and 2006, the CCJPA increased service multiple times in response to the growing demand. The CCJPA is now working on the Capitol Corridor Oakland to San Jose Project.

Phase 1 of the Oakland to San Jose track improvements and the Yolo Causeway main track, completed in 2004, allowed the Capitol Corridor to reach its current service level. The Capitol Corridor currently runs 32 weekday (22 weekend) trains between Sacramento and San Jose, and 14 daily trains between Oakland and San Jose. (Capitol Corridor Joint Powers Authority 2013 ~~2010~~)

Phase 2 of the Oakland to San Jose track improvements will increase frequency of Capitol Corridor service from 14 daily trains to 22 daily trains between Oakland and Santa Clara/San Jose. CCJPA has identified a list of track infrastructure projects to allow for the expansion of the Capitol Corridor rail service, and is moving forward with design plans and environmental review. As noted above, this is one of the projects that depends on the improvements to the south terminal area. Further improvements in the south terminal may be needed and are being studied. ~~The project does not include any capital improvements within the~~ Additionally, beyond the south terminal area, the Phase 2 Oakland to San Jose project presumes capital improvements east of the Caltrain corridor at certain locations between Oakland and Santa Clara.

BART Silicon Valley Extension

This is project number 8 in Table 4-3 and Figure 4-1.

The VTA and Bay Area Rapid Transit (BART) District are planning a 16.1-mile extension of the BART system to serve Santa Clara County. The extension would extend from Fremont to the Santa Clara Caltrain Station. The extension will be constructed in phases. The first phase, the Warm Springs Extension, covers 5.4 miles beginning just south of the planned BART Warm Springs Station in Fremont. The second phase, Berryessa Extension, will extend along the Union Pacific Rail Road

(UPRR) line through Milpitas to the Berryessa District of San Jose, near Las Plumas Avenue. The third phase, Santa Clara Extension, would be from Berryessa to Santa Clara.

Major construction on the Warm Springs Extension began in August of 2009. The Warm Springs Extension is expected to open for revenue service in the fall of 2015.

The Berryessa Extension is also under construction and is scheduled to be open in 2018. BART trains are expected to run every 15 minutes during peak commute periods on two BART lines: Green line (Berryessa–Daly City) and the Orange Line (Berryessa–Richmond). The projected opening day ridership is approximately 23,000 average weekday riders.

The Santa Clara Extension is in the environmental review phase and is expected to be in service by 2023. The Santa Clara Extension is the only part of the project that would be located in and adjacent to the Caltrain corridor. The Santa Clara Extension includes potential stations at Diridon and Santa Clara connected to the Caltrain stations and a subway or at-grade alignment between Diridon and Santa Clara. BART would be in its own ROW separate from Caltrain.

Coast Daylight

This is project number 9 in Table 4-3 and Figure 4-1.

The *California State Rail Plan* establishes strategies and priorities for the Department of Transportation to improve passenger and freight rail service for the public. Part of this plan proposes new intercity rail routes. The proposed intercity route, the Coast Daylight, would connect San Francisco, San Jose, Salinas, San Luis Obispo, Santa Barbara, Ventura, and Los Angeles. Currently the Coast Starlight, an Amtrak route, provides service from between Los Angeles and the Pacific Northwest, serving markets in California. The route operates once per day in each direction between Los Angeles and the Bay Area. The proposed Coast Daylight route would have twice as many stops at the Coast Starlight.

Coast Daylight service would support several statewide transportation objectives (Caltrans 2013):

- Providing additional capacity to serve corridor growth in a cost-effective manner with minimal impacts on local communities, natural resources, and air quality and GHG emissions.
- Increasing use of intercity passenger rail service as part of a multi-modal strategy identified in regional and county goals and plans.
- Improving rail operations by reducing travel times and increasing reliability and safety.
- Providing early implementation of a "one-seat" ride from downtown San Francisco to downtown Los Angeles.

The present proposal is to run two daily roundtrips from San Francisco to Los Angeles. No capital improvements are proposed within the Caltrain corridor for this project. The feasibility of this project is yet to be determined and is dependent on its compatibility with a blended system in the Peninsula Corridor

Pending that feasibility assessment, for the purposes of this EIR cumulative analysis only, this service is assumed to start by 2020.

Freight Rail Future Plans

This is project number 10 in Table 4-3 and Figure 4-1.

As described in Section 3.14, *Transportation and Traffic*, levels of freight operations in the corridor as of late 2012 were estimated at approximately seven round trips per day.

- San Francisco to South San Francisco freight yard—one round trip daily during daytime ("South City" Local)
- South San Francisco freight yard to Redwood City—one round trip daily during nighttime ("Broadway")
- South San Francisco freight yard to San Jose (Newhall Yard)—one round trip daily during nighttime ("Mission Bay")
- South Terminal Area (South of CP Coast) — four round trips daily ("Salinas", "Granite Rock 1", "Granite Rock 2", and "Permanente") and one one-way daily ("MRVSJ").

In addition to this routine daily traffic, freight operators also run periodic trains to serve non-routine episodic freight needs along the Caltrain corridor.

UPRR and various freight rail operators and users along the Caltrain corridor expect freight service to grow over time to accommodate demands from their various customers for freight deliveries.

- **Port of San Francisco:** The annual numbers of rail cars for the past 3 years has grown from 475 railcars in 2010, to 1,165 railcars in 2011, to 1,950 railcars in 2012 (Greenway, pers. comm.). The port projects year-on-year growth from 2012 forward to be 15 percent (Greenway, pers. comm.). Richmond Mining Limited (now Nevada Mining) has identified potential use of port facilities at Piers 90–96 to handle its iron ore (Richmond Mining, undated) and provided a letter of intent in 2010 identifying the Port of San Francisco as its favored port of loading (Richmond Mining Limited 2010). If this project were to be realized, then, starting in 2016, iron ore could start moving at a rate of 500 additional railcars/month initially and then potentially grow to as many as 1,700/month by 2018 (Greenway, pers. comm.). Assuming 75 iron ore railcars per train consist[11], 1,700 railcars/month would correspond to approximately 23 additional trains per month or less than one train/day on average. It should be noted that no environmental analysis has been commenced or completed for the proposed expansion of Piers 90–96 operations for iron ore export or the associated increase in freight rail operations. There are also other potential port options in Oakland and Richmond that could be utilized for iron ore shipping. Thus, for the likelihood for a large-scale increase in iron ore shipments along the Peninsula corridor is unknown at this time.
- **Union Pacific Railroad:** Representatives of UPRR informed Caltrain that they expect general freight growth of 4 percent per year. Representatives of UPRR also noted that if the Monterey Shale oil deposit is developed substantially in the future, there might be an increase in oil shipments through the South Terminal Area to oil refineries in the East Bay and Benicia. The potential for a large increase in Monterey Shale exploitation is a subject of intense concern and controversy at present; the potential for increased oil shipments through the Caltrain project area is unknown at this time.

[11] Estimates of iron ore consists in Utah range from 75- to 100-car consists. See: http://utahrails.net/mining/iron-mountain.php

- **Freight Operators:** The Peninsula Freight Rail Users Group, a collection of freight rail operators and users in the Caltrain Corridor including the Ports of Redwood City and San Francisco, the San Francisco Bay Railroad, CEMEX, Granite Rock, and a number of other rail users, identified in their scoping letter on the Proposed Project EIR that "it is foreseeable that freight volumes will expand significantly over the coming decades, even without any expansion of infrastructure." (Peninsula Freight Rail Users Group 2013).
- **California State Rail Plan:** The Draft *California State Rail Plan* (Caltrans 2013) estimates that tonnage at the ports of Oakland and San Francisco is expected to increase 2.5 times between 2007 and 2040. However, the plan does not provide a separate estimate for how much of this growth is expected for the Port of San Francisco or an estimate of freight rail increases along the Caltrain Corridor.

With continued economic growth on the Peninsula corridor from the present to 2040 and beyond, there will be an expanded demand for the transport of bulk cargoes and bulky materials, which could be met by expanded freight rail. Should large-scale bulk carriers decide to ship materials either in or out of the Ports of Redwood City or San Francisco, such as the proposal to expand iron ore shipments described above, there could be a substantial demand for freight shipments through the Caltrain corridor.

~~As discussed in Section 3.14, *Transportation and Traffic*, freight operations are primarily limited to operational hours of 8 p.m. to 5 a.m. with limited slots available outside of this period at present. With the Proposed Project, the FRA waiver allowing the use of light-weight EMUs on the Peninsula Corridor requires freight traffic to be limited to the hours between midnight and 5 a.m. to provide temporal separation between light-weight passenger trains and heavy freight trains. The FRA is currently engaged in a rule-making process that may alter the requirements for temporal separation which may allow larger freight operational hours. Unless FRA modifies the temporal separation requirement, any increases in freight traffic would be assumed to occur between midnight and 5 a.m. If FTA determines that temporal separation is not required, then freight increases would be assumed to occur between 8 p.m. and 5 a.m.~~

As discussed in Chapter 2, *Project Description*, the Project now assumes that temporal separation of the EMUs and freight equipment will not be required and thus that freight operational windows will not substantially change from today. Freight trains today avoid the peak hours at present, which is the period of most substantial change with the PCEP.

Freight train consists vary substantially in length. Bulk carriers, such as those that could be associated with transport of iron ore, can be particularly lengthy.

BART Millbrae Tail Tracks

This is project number 70 in Table 4-3 and Figure 4-1.

BART anticipates extending the Millbrae tail track by an additional 200–300 feet southerly into Burlingame to accommodate all 10-car trains on these tail tracks in the near future (BART 2013).

Summary of Assumed Cumulative Rail Service

Table 4-8 describe cumulative rail service assumed along the Caltrain corridor by 2040 based on review of project documents for the cumulative rail projects described above.

Table 4-8. Cumulative Existing and Future (2040) Daily Train Service Along the Caltrain Corridor

System	Tamien - Diridon	Diridon - Santa Clara	Santa Clara - Redwood City	Redwood City - San Francisco	Source
Existing (2013) Service					
Caltrain	40	92	92	92	Existing Caltrain Schedule
ACE	8	8			ACE Schedule (ACE trains layover at Tamien yard)
Capitol Corridor		14			CCJPA Schedule
Coast Starlight	2	2			AMTRAK schedule
Freight	4	9	2	6	Caltrain dispatch data
Total	**54**	**125**	**94**	**98**	
Future (2040) Service					
Caltrain	48	114	114	114	Proposed Project NOP (Appendix A)
High-Speed Rail			80 to 106	80 to 106	CHSRA *Revised 2012 Business Plan* (CHSRA 2012a)[a]
ACE	20	20			ACEforward NOP (SJRRC 2013)
Capitol Corridor		30			CCJPA Draft 2013 Vision Plan (CCJPA 2013)
Coast Daylight	4	4	4	4	2013 *California State Rail Plan* (Caltrans 2013)
Dumbarton Rail Corridor		6	6	6	2013 *California State Rail Plan* (Caltrans 2013)
Coast Starlight	2	2			No change
Freight	8	19	4	12	108% increase based on assumed 4% per annum increase
Cumulative Total	**80**	**195**	**208 to 224**	**216 to 242**	
Change from 2013	*26*	*70*	*114 to 140*	*118 to 144*	

[a] As noted above, the ~~Draft~~ 2014 Business Plan *Service Planning Methodology* document (CHSRA 2014c) includes an assumption of 53 daily round trip trains starting in 2029 and continuing beyond 2040 but the prior 2012 CHSRA Business Plan assumed 40 daily round-trip trains. ~~Caltrain's Blended Service planning to date has not studied the 2014 Business Plan estimates because the plan was released on February 7, 2014 and conceptual Blended Service studies were completed in 2013.~~ Thus, this ~~Draft~~ EIR is based on ~~the~~ 40 to 53 daily round-trip HSR trains~~, that have been studied by Caltrain to date. If more than 40 daily round-trip high-speed trains operate on the Caltrain corridor, then some operational noise impacts, such as noise, vibration, or localized traffic congestion, may be worse than disclosed in this analysis.~~ The exact number of HSR trains on the corridor in the future is unknown at this time. The subsequent CHSRA project-level environmental evaluation will address proposed high-speed train service levels along the San Francisco Peninsula.

4.1.3.2 Other Regional Transportation Improvements

Central Subway

This is project number 13 in Table 4-3 and Figure 4-1.

The Central Subway Project is a 1.7-mile extension of Muni's T Third Line from the 4th Street Caltrain Station to Chinatown, with a street-level stop at 4th and Brannan, and three underground stops at Yerba Buena (4th and Folsom Streets), Union Square (Stockton Street at Union Square), and Chinatown (Stockton and Washington Streets). The station to be located at Stockton Street at Union Square will be connected to the Powell Street BART/Muni Station to allow for convenient transfers to BART, Muni Metro lines, the Powell Street Cable Car, and Muni bus lines in the area. The extension will provide a direct connection from the Bayshore and Mission Bay areas to the South of Market, Union Square, downtown, and Chinatown areas. The extension will also provide connection from locations along the new 1.7-mile corridor to the 4th and King Caltrain Station through the already existing 4th and King/Berry T-Third line station.

The Central Subway Project is Phase 2 of San Francisco Municipal Transportation Agency's (SFMTA) Third Street Light Rail Transit Project. Phase 1 of the SFMTA Third Street Light Rail Transit Project, included a 5.1-mile light rail line along the Third Street corridor that opened in 2007. The Central Subway segment of the T-Third Line is expected to be open to the public in 2019. (SFMTA 2013)

San Francisco Municipal Railway 22-Fillmore Electric Trolley Bus Coach Re-Routing

This is project number 14 in Table 4-3 and Figure 4-1.

SFMTA proposes to move the 22-Fillmore Trolley route off of 17th and 18th Streets and onto 16th Street between Kansas Street and 3rd Street in order to between connect to the growing Mission Bay neighborhood and to provide continuous transit service along 16th Street. A revised 33-Stanyan would replace the 22-Fillmore on Connecticut and 18th Streets. SFMTA is also proposing other improvements along the 22-Fillmore route in order to reduce travel time, increase average operating speed, and improve service reliability.

This proposed realignment would mean that the trolley would cross the Caltrain tracks at-grade at 16th Street. With the proposed electrification under the Proposed Project, there would be a conflict between the overhead wires for the electric trolley coach (which is a direct current 600 volt system) and the Proposed Project (which is an alternating current 25 kV system). These electrification systems are not compatible. At discussed in the cumulative analysis of transportation below, Caltrain has identified two technical solutions that would facilitate both the Proposed Project and the 22-Fillmore to use the at-grade 16th Street crossing without conflict.

Major Highway Improvements on the Peninsula

This is project number 15 in Table 4-3 and Figure 4-1.

In the face of rapid growth on the Peninsula and San Francisco, a variety of highway improvements are planned. Major planned highway improvements within several miles of the Caltrain corridor that would cost more than $100 million apiece and that are listed in *Plan Bay Area* include the following (ABAG and MTC 2013a, no date):

- VTA Silicon Valley Express Lanes Program will convert existing carpool lanes to express lanes and add new lanes along SR 237, SR 85, and U.S. Highway 101 corridors throughout Santa Clara County (including express lanes along I-880 between U.S. Highway 101 and I-280).
- U.S. Highway 101 improvements including a high-occupancy vehicle lane from the San Francisco county line to Whipple Avenue (Redwood City); conversion of HOV lane to express lane between Whipple Avenue and Santa Clara County line; and auxiliary lanes from Marsh Road (Menlo Park) to Embarcadero Road (Palo Alto) to SR 85 (Mt. View).
- U.S. Highway 101 corridor interchange improvements at Candlestick Point (San Francisco), Produce Avenue (South San Francisco), SR 92 (San Mateo), Oregon Expressway (Palo Alto), and Zanker Road (San Jose).

Some of these projects are fully funded; others are not yet fully funded but are assumed to be funded in future years. These projects and other projects included in *Plan Bay Area* are not enough to solve the transportation problems in the corridor. The *Plan Bay Area* Final EIR (ABAG and MTC 2013b) indicates that even with these projects in place, there will be more peak period congestion and more total vehicle hours of delay in the region. Thus, there is a need for additional transit in the corridor to reduce future congestion and improve travel opportunities. Improved Caltrain service would help meet this need.

Other Major Non-Highway Improvements on the Peninsula

This is project number 16 in Table 4-3 and in Figure 4-1.

Major planned non-highway transportation improvements within several miles of the Caltrain corridor that would cost more than $100 million apiece and that are listed in *Plan Bay Area* include the following (ABAG and MTC 2013a, no date):

- Embarcadero Streetcar: Extend historic streetcar service from Fort Mason to Caltrain's San Francisco 4th and King Station.
- Southern Intermodal Terminal and MUNI T-Line Extension: Extend MUNI T-Line from Bayshore/Sunnydale to Caltrain Bayshore Station (San Francisco).
- Future grade separations in San Mateo County: Grade separations at approximately two or three high-priority candidate locations along the Caltrain corridor to separate vehicular and rail traffic for safety purposes. The locations are not yet known.
- Bus Rapid Transit (BRT) along El Camino Real: Provide BRT along El Camino Real from Palo Alto to Daly City.
- Palo Alto Caltrain Station and Bus Transit Center Expansion: Improve bus transit capacity, amenities and access to downtown Palo Alto, the Stanford campus and Stanford Shopping Center (Palo Alto).
- Grade separation at Rengstorff Avenue: Depress Rengstorff under the Caltrain tracks (Mountain View).
- Tasman Express Long T double tracking: Double-tracking of VTA's Mountain View light rail line (Mountain View/Sunnyvale, Santa Clara, San Jose).

- Mineta San Jose International Airport Automated People Mover (APM) Connector: Provide direct service from the airport to VTA's Guadalupe light-rail station, and the Santa Clara Caltrain station, and future Santa Clara BART Station.

Some of these projects are fully funded; others are not yet fully funded but are assumed to be funded in future years.

San Francisco Interstate I-280 Teardown/Boulevard/4th and King Underground Station Conceptual Planning

This is project number 73 in Table 4-3 and Figure 4-1.

The City and County of San Francisco will be conducting a study (entitled the Railyard Alternatives and I-280 Boulevard Feasibility Study) that will evaluate the feasibility of removing the end of the I-280 freeway after Mariposa Street, extending the Caltrain (and future HSR) tracks underground, creating a surface boulevard that would connect the cross-streets of Potrero Hill and SOMA neighborhoods to Mission Bay, reconnecting the adjacent neighborhoods at the San Francisco 4th and King Station, and potentially redeveloping the 4th and King Station.

Key potential elements of this concept include the following:

- The City is exploring the potential removal of I-280 north of Mariposa Street and the replacing it with an at-grade boulevard. A similar concept was completed along Octavia Boulevard with the removal of the Central Freeway and along the Embarcadero with the removal of the Embarcadero Freeway following the 1989 Loma Prieta earthquake. Planning is at an early phase but may involve a new boulevard with vehicle, bicycle, and pedestrian lanes and access, as well as commercial and residential development of areas adjacent to the boulevard, and new connections between areas east and west of the existing I-280.
- As part of the evaluation of the removal of I-280, the City is also exploring the potential to underground or realign the northern portion of the Caltrain corridor from somewhere north of Mariposa Street to the 4th and King Station.
- In addition, the City is also exploring the potential for either reconfiguring or replacing the existing 4th and King Station to allow for potential redevelopment providing housing and employment in the area.
- Other components of the City of San Francisco Railyard Alternatives and I-280 Boulevard Feasibility Study currently underway are considering the alignment and construction methods of the Downtown ~~Tunnel~~ Extension (DTX) to the Transbay Transit Center (TTC); the possibility of constructing a loop track out of the north end of the TTC which may allow for a two-track, rather than a three-track section, through the 4th and Townsend Station area; and the funding and financial opportunities from potential development that could be designated as a potential funding source for future improvements in the area, a dedicated funding stream for Caltrain, and/or general City funds.
- The anticipated study schedule is from June 2014 to July 2016.

This project is not part of any approved City planning document, has not been environmentally reviewed, and project funding has not been identified. Given this project is at a very early phase of development, it cannot be analyzed in any detail in this cumulative impact analysis.

If such a project were to advance, development would occur after the Proposed Project is complete. To complete such a project could require substantial changes to the Caltrain alignment in San Francisco and the 4th and King Station. While the removal of Proposed Project's electrical infrastructure (wires and poles) in the vicinity would require additional construction effort and cost, the electrical infrastructure would not pose a physical impediment to future development and the costs of removal would be minor in comparison with the cost of the potential improvements described above.

Geneva Avenue to US 101/Candlestick Point Interchange

This is project number 74 in Table 4-3 and Figure 4-1.

The San Francisco-San Mateo Bi-County area analyzed the Geneva Avenue extension project in the Bi-County Transportation Study (SFCTA 2013). The study was an effort to develop a priority project list and funding strategy for new transportation improvements to support the needs and anticipated growth in the area. This is a priority project for San Mateo and San Francisco counties. The timeframe for the project is 2015–2020.

This project would extend Geneva Avenue from Bayshore Boulevard to the new proposed US 101 Candlestick Point Interchange, connecting to Harney Way, and include a grade-separated Caltrain crossing at Tunnel Avenue. This new local street connection would provide access to US 101 from Brisbane Baylands as well as existing adjacent neighborhoods that would use the new street as a more direct route to US 101 than existing routes. The design would accommodate six travel lanes, two bicycle lanes, sidewalks, and potentially bus rapid transit exclusive lanes (SFCTA 2013).

4.1.3.3 Land Development Adjacent to Caltrain ROW

Planned, proposed, and under-construction land development projects adjacent or within 0.15 miles of the Caltrain ROW have the potential to be affected by the Proposed Project. Table 4-9 describes all land use projects, in various stages of development, within approximately 0.15 miles of the Caltrain ROW.

4.1.4 Cumulative Impact Analysis

This section discusses the cumulative impact analysis. Table 4-10 summarizes the cumulative impact analysis findings.

In general, if Project Variant 1 is implemented, there would be fewer cumulative construction impacts south of Tamien Station because there would be no construction activities in this area. Cumulative operational impacts would generally remain the same as described in the impact analyses below. Similarly, there would be fewer cumulative construction impacts near the 4th and King Station because electrification of the 4th and King storage yard would be deferred and cumulative operational impacts would generally remain the same. There would be no change to the cumulative impact analyses if Project Variant 3 is implemented.

Table 4-9. Land Use Development Projects Adjacent to the Caltrain ROW

Project Name (Ref #)	Description	Location	Status	Location Relative to Proposed Project
San Francisco				
4th and King Railyards Redevelopment (#17)	Existing and planned high-density residential, commercial and office uses (San Francisco Planning Department 2012)	San Francisco 4th and King Caltrain Station	Early planning	Within Caltrain ROW, Adjacent, and in OCS/ ESZ area outside ROW
Brisbane				
Brisbane Baylands Specific Plan (#18)	684-acre, 12-million-square-foot development to include a variety of uses (UPC 2010)	Between U.S. Highway 101 and Bayshore Boulevard	Proposed	Adjacent and in OCS/ ESZ area outside ROW
Opus Office (#19)	Two buildings with 448,000 square feet of office uses (City of Brisbane 2013)	3000–3500 Marina Boulevard	Proposed	0.10 mi from ROW
3710–3760 Bayshore Boulevard (#20)	2.9-acre development of two buildings with 30 residential units (City of Brisbane 2013)	3710–3760 Bayshore Boulevard	Approved. Building permit application submitted in 2010.	0.02 mi from ROW
3700 Bayshore Boulevard (#21)	~~3.6~~1.3-acre development with ~~386~~ 36 condominiums and a 4.5-acre development with 21 single-family lots (City of Brisbane 2013)	3700 Bayshore Boulevard	Tentative subdivision map submitted	0.02 mi from ROW
Millbrae				
Millbrae BART Station TOD (#68)	350 residential units and approximately 160,000 square feet of office and commercial space. (Note: The Station Area Plan provides a long-term framework for more substantial development over time.)	El Camino Real and Millbrae Avenue	Planning	Adjacent
Burlingame				
1225 Floribunda Avenue (#22)	3-story, 6-unit residential condominium (City of Burlingame 2013)	1225 Floribunda Avenue	Proposed	0.08 mi from ROW
San Mateo				
Mi Rancho Market (#23)	2-story, 12,500-square-foot market with 25 parking spaces (City of San Mateo 2013e)	80 North B Street	Proposed	0.02 mi from ROW
Gas and Shop (#24)	New fuel island, curb cut, and canopy at existing gas station (City of San Mateo 2013d)	609 East 4th Avenue	Proposed	0.13 mi from ROW

Project Name (Ref #)	Description	Location	Status	Location Relative to Proposed Project
Sadigh Mixed Use (#25)	Mixed-use building with 4,000 square feet of retail and 10 residential condominiums (City of San Mateo 2013g)	4300 S. El Camino Real	Approved	0.03 mi from ROW
Nazareth Terrace (#26)	Mixed-use building including 3,010 square feet of retail, 7,273 square feet of office, and 11 residential units (City of San Mateo 2013f)	234 7th Avenue	Approved	0.06 mi from ROW
Cal Water Office (#27)	2-story, 18,184-square-foot office building (City of San Mateo 2013c)	341 and 345 N. Delaware Street	Approved	0.11 mi from ROW
800 & 888 N. San Mateo Drive Apartments (#28)	3.08-acre development of 155 apartments units (City of San Mateo 2013a)	SE corner of Peninsula Avenue and North San Mateo Drive	Under construction	0.11 mi from ROW
2090 Delaware Apartments (#29)	2.38-acre development of 111 apartment units (City of San Mateo 2013b)	NW corner of S. Delaware Street and Pacific Boulevard	Under construction	0.10 mi from ROW
Hillsdale Station Area Plan (#75)	Station Plan area is for 150 acres in the southern area of the City of San Mateo. Plan proposes a mix of residential and commercial land uses in the area (City of San Mateo 2011)	S El Camino Real between 28th and 31st Avenues	Approved	Adjacent
North Fair Oaks Community Plan (#76)	Community plan encompasses 798 acres. Plan sets land use for the area. Plan proposed mixed residential/commercial/industrial use for the Redwood Triangle area (San Mateo County 2011)	Unincorporated San Mateo County between Redwood City and Menlo Park	Approved	Adjacent
San Carlos				
San Carlos Transit Village (#30)	Eight new buildings that would house 407,298 square feet of residential uses including 280 multiple-family dwelling units, 23,797 square feet of office uses, and 14,326 square feet of retail uses (City of San Carlos 2012)	North of San Carlos Caltrain Station	Approved	Adjacent and in OCS/ ESZ area outside ROW
Wheeler Plaza Redevelopment Project (#31)	2.65-acre redevelopment of city-owned parcel including 9,855 square feet of commercial uses and 108 residential units above a 3-level parking garage (Lamphier-Gregory 2011)	1 block west of El Camino Real and southwest of the San Carlos Avenue/Laurel Street	Proposed	0.10 mi from ROW
Redwood City				
145 Monroe Street (#32)	2.27-acre, 6-story development of 305 residential units (City of Redwood City 2013a)	Franklin Street/Monroe Street	Proposed	0.07 mi from ROW

Project Name (Ref #)	Description	Location	Status	Location Relative to Proposed Project
Classics at Redwood City (#33)	0.5-acre, 3-story development with 18 residential units and 35 subterranean parking stalls (City of Redwood City 2013c)	755 Brewster Avenue	Proposed	0.08 mi from ROW
Finger Avenue (#34)	1.7-acre development of 9 residential units	80 Finger Avenue	Proposed	0.11 mi from ROW
201 Marshall Street (#35)	0.7-acre development with 116 residential units and parking (City of Redwood City 2013b)	201 Marshall Street	Under construction	0.03 mi from ROW
Lathrop PARC (#36)	0.7-acre, 60,000-square-foot nursing facility with 114 beds (City of Redwood City 2013d)	134 Maple Street	Under construction	Adjacent and in OCS/ ESZ area outside ROW
Crossings/900 (#37)	296,000-square-foot office development with 904 parking stalls (City of Redwood City 2013e)	950 Middlefield Road	Under construction	Adjacent
Atherton				
Atherton Town Hall Complex (#67)	Update the existing town complex	91 Ashfield Road	In planning phase; Construction timing unknown	0.03 mi from ROW
Menlo Park				
389 El Camino Real (#71)	Demolition of an existing single-family house and residential triplex, and construction of 26 residential units	389 El Camino Real	Under construction	0.06 mi from ROW
500 El Camino Real (#38)	8.43-acre redevelopment with 170 housing units, 10,000 square feet pf retail space, and 199,500 square feet of office space (City of Menlo Park 2013a)	500 El Camino Real	Proposed	0.05 mi from ROW
1300 El Camino Real (#39)	3.4-acre development with 110,065 square feet of office uses and 424 parking spaces (City of Menlo Park 2013b)	1300 El Camino Real	Approved	0.08 mi from ROW
1460 El Camino Real (#40)	26,800-square-foot, 2-story office building with submerged parking and 16 two-story townhouse units with partially submerged parking (City of Menlo Park 2013c)	1452 &1460 El Camino Real and 1457 & 1473 San Antonio Street	Approved	0.11 mi from ROW
1706 El Camino Real Medical Office (#41)	2-story, 10,148 square-foot office building for medical/dental office use (City of Menlo Park 2013d)	1706 El Camino Real	Approved	0.14 mi from ROW

Project Name (Ref #)	Description	Location	Status	Location Relative to Proposed Project
El Camino Real/ Downtown Specific Plan (#69)	Redevelopment over the next 30 years of the El Camino Real corridor, the downtown area and the rail station area	Caltrain station, downtown area, and areas east and west of El Camino Real	Approved	Adjacent and in OCS/ ESZ area outside ROW
Palo Alto				
395 Page Mill Road (#42)	Two 4-story buildings with 311,000 square feet of R&D/office uses, in addition to existing 3-story building with 1,329 parking stalls (City of Palo Alto 2013b)	395 Page Mill Road	Proposed	0.12 mi from ROW
145 Hawthorne (#43)	10,503-square-foot development of three detached residential units (City of Palo Alto 2013)	145 Hawthorne Avenue	Planning	0.07 mi from ROW
195 Page Mill Road (Park Plaza) (#44)	3-story mixed-use building with 82 residential rental units (104,174 square feet) and 47,917 square feet of ground floor commercial and retail use (City of Palo Alto 2013a)	195 Page Mill Road	Under construction	Adjacent ~~and in OCS/ESZ area outside ROW~~
3445 Alma Street (Alma Plaza) (#45)	20,000-square-foot grocery store and an additional 6,000 square feet of commercial space (City of Palo Alto 2013c)	3445 Alma Street	Under construction	0.08 mi from ROW

Project Name (Ref #)	Description	Location	Status	Location Relative to Proposed Project
Mountain View				
100 Moffett Boulevard (#46)	2.9-acre development of three 2- to 4-story buildings with 190 units (ICF International 2012)	100 Moffett Boulevard	Planning	0.03 mi from ROW
209-405 West Evelyn (#47)	4.2-acre development of 65 residential units (Grand Boulevard Initiative 2012)	209–405 West Evelyn	Under construction	0.03 mi from ROW
100-200 West Evelyn (#48)	4.33-acre development with 48,738 square feet of office space (Grand Boulevard Initiative 2013)	100–200 West Evelyn	Under construction	Adjacent and in OCS/ESZ area outside ROW
902 Villa Street (#49)	4-story building with 21,745 square feet of office space (Grand Boulevard Initiative 2013)	902 Villa Street	Under construction	0.08 mi from ROW
871 West Evelyn (#50)	4-story building with 65,000 square feet of office space.	871 West Evelyn	Under construction	Adjacent
San Antonio Station (#51)	Remove Heritage Trees	100 Mayfield Avenue	Planning	Adjacent
Northpark Apartments (#52)	Addition of 134 residential units to an existing 188 residential unit apartment complex (Environmental Planning Commission 2012)	111 North Rengstorff Avenue	Under construction	0.09 mi from ROW
South Whisman Precise Plan (#53)	New, 38-acre residential community with 1,210 housing units and 37,000 square feet of commercial space (Mountain View City Council 2009)	Ferguson Road, Near Whisman Station	Phased over time	0.20 mi from ROW
Tripointe Homes (#54)	Four rowhouses	129 Ada Avenue	Planning	0.08 mi from ROW
Pacific Press – Courtyard (#55)	Precise Plan Amendment	1200 Villa Street	Inactive	Adjacent and in OCS/ ESZ area outside ROW
Sunnyvale				
Carmel Lofts (#56)	Two buildings with 133 apartment units in 4 stories and 8,000 square feet of ground floor retail space (City of Sunnyvale 2013)	Adjacent to Plaza del Sol off of Frances Avenue and Olson Way	Under construction	0.08 mi from ROW
Lawrence Station Area Plan (Sunnyvale and Santa Clara) (#66)	Planning document for the vicinity of the Lawrence Station that includes mixed-use development	106 Lawrence Station Road	Planning	Adjacent and in OCS/ ESZ area outside ROW
Santa Clara/San Jose				

Project Name (Ref #)	Description	Location	Status	Location Relative to Proposed Project
Santa Clara Station Area Plan (#57)	Plan for 432 acres surrounding Santa Clara Transit Center for future transit-oriented development (VTA 2010)	Santa Clara Caltrain Station	Approved. Incremental construction over time	Adjacent and in OCS/ ESZ area outside ROW
San Jose				
Earthquakes Stadium (#58)	18,000-seat professional sports stadium.	1105-1125 Coleman Avenue	Under construction	Adjacent
Former FMC site, also called Coleman Highline (PDC98-104, PD12-019) (#59)	Up to 3 million square feet of office/R&D space next to Earthquakes stadium	1115 Coleman Avenue	Construction in 2014/ 2015	Adjacent
Alameda (PD12-017) (#60)	2.19-acre development of a 33,900-square-foot grocery store (Whole Foods) (San Jose Planning Commission 2012)	155 Stockton Avenue	Construction in 2013/2014	0.06 mi from ROW
Morrison Park Townhomes (PD06-094) (#61)	4.44-acre multi-family attached residential development with 250 townhome units, 425 parking stalls, and 1.16 acres of open space (Civil Engineering Associate 2006)	Cinnabar and Stockton Streets	Under construction	0.08 mi from ROW
785-807 The Alameda (PDC13-007) (#62)	1.04-acre development with 98 residential units and 22,660 square feet of commercial use (City of San Jose 2013b)	785-807 The Alameda	Planning	0.11 mi from ROW
Baseball Stadium (PP05-214) (#63)	1.5-million-square-foot baseball stadium with a capacity of 45,000 and 1,200 space parking garage (LSA Associates 2007)	245 S. Montgomery Street	EIR certified	Adjacent and in OCS/ ESZ area outside ROW
Park Avenue Senior and Family Housing (PDC13-012) (#64)	2.15-acre development of 181 family and senior apartments (City of San Jose 2013c)	777 Park Avenue	Planning	0.02 mi from ROW
OSH West San Carlos (H13-008) (#65)	48,000-square-foot commercial building (City of San Jose 2013a)	720 W. San Carlos Street	Construction Summer 2013	Adjacent and in Proposed Project OCS/ ESZ area outside ROW
Diridon Station Area Plan (#72)	Plan for expansion of and development around the Diridon Transit Station (approximately 500 acres)	At and adjacent to Diridon Station	Planning	Adjacent and in OCS/ ESZ area outside ROW

Sources: See Table 4-2.

Table 4-10. Summary of Cumulative Impacts Analysis

Resource Issue	Geographic Area of Impact	Rail Projects Planned in the Caltrain ROW				Other Regional Transportation Improvements		Land Development Adjacent to Caltrain ROW		Cumulative Impact (including Proposed Project)		Is Proposed Project's Contribution Considerable?	
		CAHSR Blended Service		Other Projects									
		Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation
Aesthetics	Caltrain ROW and vicinity	LTSM	PS	LTSM	PS	LTSM	PS	LTSM	PS	LTSM	PS	LCCM	CCU
Air Quality	Criteria pollutants: San Francisco Bay Area Air Basin	LTSM	Beneficial	LTSM	Beneficial	LTSM	PS	LTSM	LTSM	LTSM	LTSM	LCCM	Beneficial
	Toxic air contaminants: Caltrain ROW and immediate vicinity	LTSM	LTS	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LCCM	Beneficial
Biological Resources	Terrestrial species: ROW and adjacent Aquatic species: ROW and downstream	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LCCM	LCCM
Cultural Resources	Caltrain ROW and adjacent to ROW	**Historical Resources**											
		PS/UNK	NI	PS/UNKN	NI	PS/UNK	NI	PS/UNK	NI	PS/UNK	NI	LCCM	NI
		Archaeological Resource											
		LTSM	NI	LTSM	NI	LTSM	NI	LTSM	NI	LTSM	NI	LCCM	NI
		Human Remains											
		LTSM	NI	LTSM	NI	LTSM	NI	LTSM	NI	LTSM	NI	LCCM	NI
EMF/EMI	Caltrain ROW and adjacent to ROW	**Electromagnetic Fields**											
		LTS	LTS	LTS	NI	LTS	NI	LTS	NI	LTS	LTS	LCC	LCC
		Electromagnetic Interference											
		LTS	LTSM	LTS	NI	LTS	NI	LTS	NI	LTS	LTSM	LCC	LCCM
Geology, Soils and Seismicity	Caltrain ROW and adjacent to ROW	LTSM	NI	LTSM	NI	LTSM	NI	LTSM	NI	LTSM	NI	LCCM	NI
GHG Emissions and Climate Change	The Planet (GHG emissions) San Francisco Peninsula (vulnerability to climate change impacts, excluding sea level rise)	**Greenhouse Gas**											
		Beneficial		LTSM		LTSM		LTSM		LTSM		Beneficial	
		Climate Change (excluding Sea Level Rise)[a]											
		NI	LTS	NI	LTS	NI	LTS	NI	PS	NI	PS	NI	LCC
Hazards and Hazardous Materials	Caltrain ROW and adjacent to ROW	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LCCM	LCCM
Hydrology and Water Quality	Caltrain ROW and downstream	**Hydrology and Water Quality (other than Flooding due to Sea Level Rise)**											
		LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LCCM	LCCM
		Flooding due to Sea Level Rise											
		NI	PS	NI	PS	NI	PS	NI	PS	NI	PS	NI	CCU
Land Use and Recreation	Adjacent to Caltrain ROW	LTSM	PS	LTSM	PS	LTSM	PS	LTSM	PS	LTSM	PS	LCCM	LCCM
Noise and Vibration	Caltrain ROW and adjacent to ROW	**Noise**											
		PS	PS	PS	PS	PS	PS	PS	LTSM	PS	PS	CCU	CCU
		Vibration											
		LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LCCM	LCCM
Population and Housing	Project counties	LTSM	LTSM	LTSM	NI	LTSM	LTSM	LTSM	NI	LTSM	NI	NI	NI

Resource Issue	Geographic Area of Impact	Rail Projects Planned in the Caltrain ROW				Other Regional Transportation Improvements		Land Development Adjacent to Caltrain ROW		Cumulative Impact (including Proposed Project)		Is Proposed Project's Contribution Considerable?	
		CAHSR Blended Service		Other Projects									
		Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation
Public Services and Utilities	Caltrain ROW and adjacent to ROW (Construction) Service areas of regional providers to project sites (Operations)	**Disruption to Utilities**											
		LTSM	NI	LTSM	NI	LTSM	NI	LTSM	NI	LTSM	NI	LCCM	LCC
		Public Services											
		LTSM	LTS	LTSM	LTS	LTSM	LTS	LTSM	LTSM	LTSM	LTSM	LCCM	LCC
		Landfill Capacity											
		LTSM	LTS	LTSM	LTS	LTSM	LTS	LTSM	LTSM	LTSM	LTSM	LCC	LCC
Transportation and Traffic	Caltrain ROW, roadways crossing ROW, and roadways near stations (traffic level of service, bicycle and pedestrian facilities) San Francisco Peninsula (regional traffic, regional transit systems)	LTSM	PS	LTSM	PS	LTSM	PS	LTSM	PS	LTSM	PS	LCCM	CCU

[a] Flooding related to sea level rise is included in the hydrology and water quality impacts.
LTS = Less than significant.
LTSM = LTS with mitigation.
PS = Potentially significant.
NI = No impact.
UNK = Unknown.
NA =Not applicable.
LCC = Less than considerable contribution.
LCCM = LCC with project mitigation.
CCU = Cumulatively considerable and unavoidable.

1

4.1.4.1 General Characteristics of Cumulative Projects for the Cumulative Analysis

Construction

There is the potential for cumulative construction impacts where cumulative projects and the Proposed Project overlap in location or are adjacent (affecting the same resource/receptor but potentially at different times), or if they overlap in time (affecting the same resource/receptor at the same time).

Blended Service

Construction of the San Jose to Merced section of the HSR system would occur sometime after 2020 and be completed by 2026.

Construction associated with Blended Service between San Jose and San Francisco would include passing tracks, station development at Diridon and Millbrae (and possibly Redwood City), trackage improvements, at-grade crossing improvements and a maintenance facility. Construction would occur sometime after 2020 after the Proposed Project construction is completed.

Thus, construction of the Proposed Project and HSR improvements would not overlap in time. However, with a 4-year construction schedule for Proposed Project and then a multi-year construction period for HSR, there would be potential for cumulative construction impacts that would be longer in duration with both projects than with only the Proposed Project.

Other Rail Projects in or Adjacent to the Caltrain ROW

As described in Table 4-3, only some of the other rail projects would have actual construction in or adjacent to the Caltrain ROW, specifically, Caltrain South Terminal (#4), BART Silicon Valley Extension (#8), bridge or tunnel work if needed to accommodate higher freight service in the future (#10), San Bruno Grade Separation project (#11), other Caltrain improvements (#12), and the BART Millbrae tail tracks (#70). Some of these projects would be constructed prior to Proposed Project construction, some during, and some after the Proposed Project is completed.

Other Transportation Projects

As described in Table 4-3, only some of the other transportation projects would have actual construction in or adjacent to the Caltrain ROW, specifically, Central Subway (#13), Muni 22-Fillmore re-route (#14); some of the non-highway improvements (#16), and San Francisco's potential future project related to I-280 teardown (#73). Some of these projects would be constructed prior to Proposed Project construction, some during, and some after the Proposed Project is completed.

Land Development Projects Adjacent to the Caltrain Row

As shown in Table 4-3, none of the land development projects, with the exception of potential future redevelopment of the 4th and King Station and yard (#17) is located within the Caltrain ROW. However, a number of these projects are adjacent to the Caltrain ROW and some of them are located in areas of minor encroachment by the Proposed Project for OCS or ESZ requirements. Some of these

projects would be constructed prior to Proposed Project construction, some during, and some after the Proposed Project is completed.

Operations

Blended Service

Operation of a statewide HST will yield transportation and environmental benefits, including: enhanced inter-regional mobility from a new transportation mode; reductions in statewide and Bay Area vehicle miles travelled; reduced energy consumption for transportation; air quality improvements; and reduced emissions of greenhouse gases (CHSRA 2005).

CHSRA plans for operational HSR service to San Jose by as early as 2026 (pursuant to the 2014 CHSRA Business Plan); thus there could be potential cumulative effects after that date of the San Jose to Merced section of HSR where it is parallel to the Caltrain ROW between San Jose Diridon Station and south of the Tamien Station. The earliest date for potential Blended Service between San Jose and San Francisco would be sometime between 2026 and 2029. Thus, there would be no cumulative operational impacts of the Proposed Project and Blended Service until those dates.

Other Rail Projects in the Caltrain ROW

The other rail projects have various planned in-service dates. Some, such as ACEforward (#6), Capitol Corridor improvements (#7), and the Coast Daylight project (#9), would increase service in the Caltrain corridor by 2020. Freight service could increase, as well. Once the Proposed Project is operational (first full year expected to be 2020), there is potential for cumulative operational impacts to occur as other passenger and freight rail service increases over time. To analyze the potential full impact of such proposed increases, this analysis uses the service increases shown in Table 4-8 for 2040.

Land Development Projects Adjacent to the Caltrain Row

As shown in Table 4-3, none of the land development projects, with the exception of potential future redevelopment of the 4th and King Station and yard (#17) is located within the Caltrain ROW. However, a number of these projects are adjacent to the Caltrain ROW and some of them are located in areas of minor encroachment by the Proposed Project for OCS or ESZ requirements. Some of these projects would be constructed prior to Proposed Project construction, some during, and some after the Proposed Project is completed.

Operations

Blended Service

Operation of a statewide HST will yield transportation and environmental benefits, including: enhanced inter-regional mobility from a new transportation mode; reductions in statewide and Bay Area vehicle miles travelled; reduced energy consumption for transportation; air quality improvements; and reduced emissions of greenhouse gases (CHSRA 2005).

CHSRA plans for operational HSR service to San Jose by as early as 2026 (pursuant to the 2014 CHSRA Business Plan); thus there could be potential cumulative effects after that date of the San Jose to Merced section of HSR where it is parallel to the Caltrain ROW between San Jose Diridon Station and south of the Tamien Station. The earliest date for potential Blended Service between San

Jose and San Francisco would be sometime between 2026 and 2029. Thus, there would be no cumulative operational impacts of the Proposed Project and Blended Service until those dates.

Other Rail Projects in the Caltrain ROW

The other rail projects have various planned in-service dates. Some, such as ACEforward (#6), Capitol Corridor improvements (#7), and the Coast Daylight project (#9), would increase service in the Caltrain corridor by 2020. Freight service could increase, as well. Once the Proposed Project is operational (first full year expected to be 2020), there is potential for cumulative operational impacts to occur as other passenger and freight rail service increases over time. To analyze the potential full impact of such proposed increases, this analysis uses the service increases shown in Table 4-8 for 2040.

Other Transportation Projects

Other transportation projects concerning highways, light rail, or other transit systems would not result in cumulative operational impacts along the Caltrain ROW itself. However, there is potential for cumulative operational impacts at areas where light rail or transit projects intersect with Caltrain stations or the Caltrain ROW and for traffic overall with roadway projects that may facilitate increased traffic.

Land Development Projects Adjacent to the Caltrain ROW

Land development projects would not affect rail service itself, but could result in cumulative operational impacts related to general traffic, air quality, noise and other operational issues in combination with the Proposed Project. In addition, land development projects adjacent to the Caltrain ROW would result in additional residential and commercial receptors of operational train noise impacts resultant from Proposed Project and other rail projects.

4.1.4.2 Aesthetics

Impact CUMUL-1-AES: Cumulative impacts on visual aesthetics

The geographical context area for the analysis of potential cumulative aesthetic impacts consists of the areas adjacent to, within, and in the vicinity of the Caltrain ROW. The existing setting for the Proposed Project is presented in Section 3.1, *Aesthetics*. Cumulative projects within this geographic context include all projects listed in Table 4-3, but the cumulative impact area is limited to the extent of cumulative projects in or adjacent to the Caltrain ROW. The Proposed Project would not contribute to any potential cumulative aesthetic impacts that occur at distance from the Caltrain ROW, such as the potential impacts of HSR between San Jose and Merced.

Construction

Scenic Vistas

The Caltrain ROW and adjacent areas are primarily located in the midst of urban and suburban development on the Peninsula corridor. As discussed in Section 3.1, *Aesthetics*, while some of the area has a high localized visual quality, there are very limited long-range scenic vistas that include the Caltrain ROW, due to the developed character of the ROW and vicinity, its location at-grade in a generally flat area and due to the intervening vegetation and buildings blocking scenic vistas.

Visual signs of construction of the Proposed Project, Blended Service improvements, HSR San Jose to Merced, and other construction along the Caltrain ROW would include construction equipment and stockpiling of soils, as well as new structures. During this phase, construction activity would be highly noticeable to residents and others in the immediate vicinity.

The view from bridges would be fleeting for crossing motorists, bicyclists, and pedestrians, and construction would not affect their long-range views because viewers would be elevated above the Caltrain ROW and other construction activities. The view from adjacent multi-level buildings of the Santa Cruz Mountains, San Francisco Bay, or San Bruno Mountain would not be blocked by cumulative construction activities. Cumulative construction activities would not likely be seen from distant hillsides because of intervening features and activities except for substantial elevated structures. Elevated structures could be associated with HSR north and south of the San Jose Diridon Station if an aerial station option is selected.

Ground level views from adjacent residential, commercial, and park areas would be affected by construction where the Caltrain ROW is visible from these adjacent areas, but these views are short-range in character, not long-range scenic vistas.

Cumulative construction activities although of a longer duration when combining Proposed Project and cumulative projects would, thus, have less-than-significant impacts on scenic vistas. Thus, the Proposed Project would have a less-than-considerable contribution to cumulative aesthetic impacts relative scenic vistas.

Scenic Resources within or along a Designated Scenic Roadway

As discussed in Section 3.1, *Aesthetics*, there are no designated scenic roadways directly adjacent to the Caltrain ROW between San Jose and San Francisco except I-280 in San Francisco. Given that I-280 is elevated where it crosses the Caltrain ROW and Proposed Project, and that Blended Service and other rail projects would use the Caltrain ROW itself, construction of cumulative rail service is not likely to affect any scenic resources associated with I-280. The Proposed Project would not affect any scenic resources within a designated scenic roadway during construction. While other cumulative projects may affect scenic resources along a designated scenic roadway during construction, the Proposed Project would not make any contribution to such potential impacts that are not in or adjacent to the Caltrain ROW itself. Therefore, the Proposed Project's contribution to potential cumulative construction impacts on scenic resources along a designated scenic roadway would be less than considerable

Visual Character

This impact concerns temporary visual changes during construction. Cumulative construction of concern for this analysis would occur in or adjacent to the Caltrain ROW. As described in Section 3.1, *Aesthetics*, the character of the areas adjacent to the Caltrain corridor vary from residential to commercial to industrial and includes a number of park areas as well. Cumulative construction would be most out of character in residential and park areas and less out of character in commercial and industrial areas or in transportation corridors (like the Caltrain ROW). Where construction activities are present for an extended period of time in or directly adjacent to residential or park areas, there could be a temporarily significant aesthetic impact.

For the Proposed Project, Mitigation Measure AES-2a is required to minimize the Proposed Project's temporary impacts on residential and park areas outside the Caltrain ROW. Although other

cumulative projects may also result in a temporary change of visual character of areas adjacent to the Caltrain ROW during construction, with the recommended mitigation measure, the Proposed Project's contribution to cumulative temporary changes in visual character would be less than considerable.

Light and Glare

Both the Proposed Project and Blended Service improvements would require night-time construction. Other railway and transportation projects and possibly some of the land use projects may also require night-time construction as well. This could result in light spill over into adjacent residential areas, which if uncontrolled could be significant.

During Proposed Project nighttime construction, pursuant to Mitigation Measure AES-4a, the JPB will require the project contractor to ensure that construction crews working at night direct any artificial lighting onto the work site, to minimize spill over light or glare in adjacent residential areas. With this mitigation, the project's contribution to a potential cumulative impact on light and glare during construction is not considerable.

Operation

Scenic Vistas

Blended Service

As noted above, the Caltrain ROW is not a readily observable part of a scenic vista due to its setting in an urban and suburban context with few long-range scenic views of the ROW itself. In the San Jose to Merced HSR segment, the approaching aerial tracks between the Caltrain Tamien Station and the San Jose Diridon Station would elevated and would be highly observable as part of long range views of downtown San Jose. For Blended Service improvements north of Diridon, potentially elevated structures between San Jose to Santa Clara and for grade separations elsewhere would have the greatest potential to affect scenic vistas. The maintenance yard, if proposed at the Brisbane/Bayshore location close to U.S. Highway 101, may also be readily observable by passing motorists, although this area at present consists of formerly used industrial and landfill property and is not particularly of a high visual quality. Passing tracks will be noticeable to local communities, but if at-grade, would not disrupt scenic vistas.

All Other Projects

Cumulative projects along the Caltrain ROW could also affect scenic vistas from buildings, hillsides, and bridges and other locations, particularly where new highly elevated structures are proposed that are dissimilar to existing development along the ROW.

Proposed Project Cumulative Contribution

While cumulative projects could affect scenic vistas where new structures affect long-range views of the Santa Cruz Mountains, San Francisco Bay, or other visual resources, the Proposed Project itself would only have minimal impacts on long-range views because the Proposed Project improvements would be difficult to distinguish among the developed areas along the Caltrain ROW. Moreover, the Proposed Project improvements installed as part of the Caltrain ROW would be consistent with the character of the ROW as a rail corridor such that they would not substantially change this part of a

long-range view. Consequently, the Proposed Project's contribution to the cumulative impact on scenic vistas would be less than considerable.

Scenic Resources within or along a Designated Scenic Roadway

As noted above, the Proposed Project would not affect any scenic resources within a designated scenic roadway. While other cumulative projects may affect scenic resources along a designated scenic roadway, the Proposed Project would not make any contribution to such potential impacts that are not in or adjacent to the Caltrain ROW itself. Therefore, the Proposed Project's contribution to potential cumulative operational impacts on scenic resources along a designated scenic roadway would be less than considerable.

Visual Character

Blended Service

The aerial structures and new trackage proposed for HSR for the San Jose to Merced segment approaching San Jose from north of SR 82 and the Diridon Station would be located along the Caltrain ROW and would affect the visual character of existing areas along the ROW, particularly where the Caltrain ROW is adjacent to residential areas in San Jose. A potential aerial structure from the Diridon Station to Santa Clara would also change the visual character of this area although much of the Caltrain ROW is adjacent to commercial and industrial areas to the east.

The Blended Service proposed improvements between Santa Clara and San Francisco could affect the visual character of areas along the passing tracks, at Diridon and Millbrae Stations (and possibly Redwood City Station), at the maintenance yard location, and potentially in other areas where grade separations or other improvements are proposed. While station changes could be substantial, given that these are existing stations, the new stations would be generally consistent with existing visual character. However, depending on the specific design, though compatible with current uses, the actual character could be substantially changed. This would be more acute at a historic station (such as Diridon) than a station with extensive recent visual changes (such as Millbrae).

The impact of the passing tracks on visual character would depend on their location and design. The general visual setting of the preliminary 5 locations studied to date is as follows

- The North 4 Track (San Francisco to Burlingame): Areas adjacent to the northern part of this section are primarily industrial and commercial in Brisbane and South San Francisco. Areas adjacent to the southern part of this section are dominated by adjacent residential areas in San Bruno (including two parks), a mix of residential and commercial uses in Millbrae and Burlingame.
- The Long-Middle 4 Track (San Mateo to Redwood City): Areas adjacent to the northern part of this section contains a mix of adjacent commercial and residential areas in San Mateo, transitioning to primarily residential areas in Belmont, primarily commercial areas in San Carlos, with a mix of commercial and residential areas in Redwood City. Several parks are adjacent in San Mateo and Redwood City.
- The Short-Middle 4 Track (San Mateo to San Carlos): Areas adjacent to the northern part of this section contain a mix of adjacent commercial and residential areas in San Mateo (including one adjacent park), transitioning to primarily residential areas in Belmont and commercial areas in San Carlos.

- The Middle 3 Track (San Mateo to Palo Alto): Areas adjacent to the northern part of this section contain a mix of adjacent commercial and residential areas in San Mateo, transitioning to primarily residential areas in Belmont, commercial areas and San Carlos and a mix of commercial and residential areas in Redwood City. The southern part of this section includes adjacent residential areas in Atherton, Menlo Park, and Palo Alto, with commercial areas in downtown Menlo Park and Palo Alto. Several parks are adjacent in San Mateo, Redwood City, Atherton and Palo Alto.
- The South 4-Track (Mountain View to Santa Clara): Areas adjacent to this section contains a mix of residential and commercial areas including several parks in Mountain View.

Within areas where adjacent land uses are commercial or industrial in character, additional passing tracks, even if outside the ROW, would not have a significant impact on visual character. In residential areas or areas with parks, expansion outside the ROW for passing tracks, where necessary, could change the visual character of the land immediately adjacent to the existing Caltrain ROW itself.

The impact of a new maintenance yard and any grade separations or other improvements would also depend on their location. The previously studied maintenance yard location in Brisbane/ Bayshore (in the 2010 CHSRA alternatives analysis) is in an area of historic industrial, railroad and landfill use, but the area is proposed for redevelopment with residential, commercial, industrial and park use by the Brisbane Baylands project. Depending on the uses extant at the time of Blended Service, the addition of maintenance yard at the Brisbane/Bayshore location may or may not be consistent with the visual character at that time.

As indicated in Table 4-8, the corridor is presently used by nearly 100 trains per day between Santa Clara and San Francisco and 125 trains per day between Santa Clara and San Jose. Thus, the addition of HST trains themselves (in combination with other rail increases) will not change the visual character of the Caltrain corridor as a transportation corridor. The changes in noise and vibration due to additional trains on adjacent land uses is discussed separately below.

Overall aesthetic impacts of new HSR facilities for the San Jose to Merced segment and for Blended Service facilities between San Jose and San Francisco are considered potentially significant depending on their ultimate location and design. The highest potential for significant visual character impacts would be for any elevated grade separations or passing tracks outside the Caltrain ROW if located in sensitive visual areas such as residential areas or parks.

All Other Projects

During operation, the cumulative projects could change the visual character in the project area due to permanent structures and changes in landscaping.

Cumulative transportation projects would introduce new features such widened roadways, bridges and interchanges, aerial and at-grade tracks, overhead power lines and grade separations. Cumulative transportation projects would also increase passenger and freight rail, light rail, and roadway use as well although such increase in use would not change the aesthetic character of existing roadway, rail, and light rail corridors unless facilities in new locations are proposed. In some cases, cumulative transportation projects would affect Caltrain station aesthetics (such as at Diridon, Santa Clara, 4th and King, Millbrae, and Palo Alto, among others) that are also affected by the Proposed Project.

Other passenger and freight service increases would contribute to the change in intensity of the Caltrain corridor combined with increased Caltrain and HSR rail service due to the more than doubling of overall number of trains by 2040.

Cumulative land use development would introduce new building structures which may or may not be consistent with the current visual character. Many locations along the Caltrain ROW, particularly in downtown areas and near many Caltrain stations are seeing increased density of residential and commercial development including transit-oriented development. In many of the more suburban communities, this increased density and diversity of land use represents a change from the single-family residential visual character of some of these communities. In more urbanized areas, such as San Francisco or downtown San Jose, the change in character is more one of intensity in that these areas are substantially developed at present with new development only increasing the existing densities and heights of development.

PS4, Options 1 and 2 would be located within an area envisioned for Transit Oriented Development and a Transit Center and associated improvements as part of the Hillsdale Station Area Plan. As concluded in Section 3.10, these two options would require minor reconfiguration of the plan, and may be adjacent to potential future residential or park/plaza uses. If PS4, Options 1 or 2 are selected and the adjacent areas are actually proposed for residential and/or park/plaza use, then Mitigation Measure AES-2b would be implemented for these locations. If PS4, Option 3 is selected, then no mitigation would be required.

As described in Section 3.3, Caltrain will coordinate with the City of San Carlos in regards to potential tree plantings associated with the San Carlos Transit Village and will apply Mitigation Measure BIO-5 as appropriate to project tree effects.

SWS Option 1 would be located adjacent to, but not in an area proposed for mixed residential/commercial/light industrial use in the Redwood Triangle portion of the North Fair Oaks Community Plan. Given the mixed-use designation, it is more likely that future residential redevelopment would not happen directly adjacent to the Caltrain mainline but would rather likely occur on the north part of Redwood Triangle, closer to Middlefield Road to separate residential development from the active mainline and to provide residential development close to services and transit connections along Middlefield Road. The area north of the active tracks is used and will likely continue to be used for laydown of equipment and supplies; a use that will continue whether or not the PCEP switching station is placed at the proposed location. If commercial or light industrial development occurs along the southern perimeter of Redwood Triangle, the switching station would be obscured from view from other areas within Redwood Triangle, similar to current conditions. Nevertheless, if in the future, the switching station is constructed at the proposed location and there is a viable proposed residential development on the site that would have an unobstructed view of the switching station with no intervening development, then Caltrain is willing to apply Mitigation Measure AES-2b to the switching station location and provide vegetative screening, as feasible on the north side of the switching station in order to ensure that aesthetic impacts would be less than significant in that situation. This mitigation will only be required if adjacent areas are actually proposed to be developed for residential use and will not be required until that is a reality. The JPB has also identified a second option, SWS1, Option 2, located north of the JPB tracks adjacent to the Orchard Supply Hardware and Costco in Redwood City just to the west of Redwood Junction that would not be adjacent to the proposed mixed use area.

As described in Section 3.1, there are overlapping vegetative screening requirements relative to the mixed use development at 195 Page Mill Road in Palo Alto and the mitigation requirement for Mitigation Measure AES-2b for PS5, Option 2. As required in the mitigation measure, the JPB will coordinate with the project developer during design.

Proposed Project Cumulative Contribution

As discussed in Section 3.1, *Aesthetics*, the Proposed Project would have permanent effects on aesthetics along the Caltrain ROW due to the OCS, the TPFs, and tree removal/trimming.

The addition of the OCS would affect the visual character of some visually sensitive areas, including adjacent residential areas, parks and Caltrain historic stations. Implementation of Mitigation Measure AES-2b would ensure that OCS poles recede into the visual landscape as much as feasible. Because the OCS would be limited to along the Caltrain ROW itself and would be a linear feature consistent with existing railroad ROW visual character and Mitigation Measure AES-2b would help to reduce the visual obviousness of the OCS, the Proposed Project's OCS would make a less-than-considerable contribution to potential cumulative impacts on visual character.

However because of permanent tree removal for the OCS/ESZ requirements, the Proposed Project may have a localized significant and unavoidable impact on visual character in specific locations where implementation of required mitigation (Mitigation Measure BIO-5) for tree replacement would not avoid a significant change in localized visual character. Where cumulative projects also substantially change visual character in areas where the Proposed Project would also have permanent aesthetic effects, there may be a cumulatively significant impact on localized visual character. In such areas, albeit localized, the Proposed Project is considered have a cumulatively considerable and unavoidable impact on visual character.

Light and Glare

Blended Service

Blended Service could introduce new lighting at stations at Diridon, Millbrae, and possibly Redwood City, as well as at any new maintenance areas. If uncontrolled such additional lighting could spill over into adjacent residential areas; however such lighting is usually readily controllable through appropriate lighting controls.

In addition, the HSR trains, when running at night would increase train light along the Caltrain ROW itself. Because the Caltrain ROW already has train light as part of the existing setting at night, the addition of more train light is not considered a significant impact.

All Other Projects

Other cumulative projects could introduce new lighting as part of residential, commercial, or transportation projects. If uncontrolled, additional structural lighting could spill over into adjacent residential areas; however such lighting is usually readily controllable through appropriate lighting controls. Transportation projects would likely increase train and vehicle light along existing transportation corridors, including the Caltrain ROW. Where this occurs on existing rail and roadway corridors, the addition of more train or vehicle light is not considered a significant impact.

Proposed Project Cumulative Contribution

The Proposed Project could introduce new lighting or glare associated with the TPFs and OCS that could affect the visual character of the area along the Caltrain ROW if uncontrolled and this could contribute to cumulative light and glare impacts. However, with the implementation of Mitigation Measures AES-2b and AES-4b, the Proposed Project's contribution to potential cumulative light and glare impacts would be reduced to a less-than-considerable level.

4.1.4.3 Air Quality

As discussed in Section 3.2, *Air Quality*, the Proposed Project would be consistent with regional air quality plans and would only result in routine construction odors, and would reduce operational odors. Thus these issues are not the focus of this cumulative analysis which focused on criteria pollutants and toxic air contaminants.

The geographic context for the analysis of cumulative criteria pollutant impacts is the San Francisco air basin as criteria pollutant emissions are a regional concern. Past, present and probable future cumulative projects within this geographic context include all projects listed in Table 4-3 as well as the general growth included in Table 4-1.

The geographic context for the analysis of cumulative toxic air contaminants impacts is the immediate area along the Caltrain ROW that is presently affected by diesel emissions and would be changed with the Proposed Project. Past, present and probable future cumulative projects within this geographic context include only those projects listed in Table 4-3 that are in, adjacent to the Caltrain ROW or within a short distance from the Caltrain ROW.

Impact CUMUL-2-AQ: Cumulative effects on air quality

Construction

Criteria Pollutants

During construction of the cumulative projects listed in Table 4-3 and the overall growth shown in Table 4-1, criteria pollutants that could impact air quality in the San Francisco air basin would be emitted. Construction of the cumulative projects may emit criteria pollutants singularly that could exceed the allowable threshold for criteria pollutants in the basin or could exceed these thresholds for the combined effect of cumulative construction that occurs at the same time. Therefore, the cumulative projects would have a significant cumulative impact on air quality due to construction. In the Bay Area, all discretionary projects evaluate their construction air quality emissions and usually compare them to the BAAQMD's construction daily or annual thresholds for criteria pollutants. The BAAQMD's thresholds are designed so that if all projects meet those thresholds, then regionally construction would not have a significant effect on regional air quality. Through the CEQA process, lead agencies usually require that individual projects that exceed the thresholds provide mitigation to reduce emissions to the threshold levels, where feasible. However, for some large projects, it may not be feasible to always reduce to the adopted thresholds.

For the San Jose to Merced HSR segment and for Blended Service improvement construction, CHSRA would employ the project design features that it has included in prior project-level documents, such as fugitive dust controls. The project-level environmental documents for the HST Merced to Fresno segment (CHSRA 2012d) and the HST Fresno-Bakersfield segment (CHSRA 2012e) both concluded

that project construction criteria pollutants would be significant before mitigation, but could be reduced to a less than significant levels with project mitigation (including reduction of exhaust emissions from construction equipment and on-road vehicles and purchase of offsets where onsite mitigation was insufficient to lower construction emissions below relevant thresholds). A similar conclusion is likely for San Jose to Merced HSR segment and Blended Service improvements construction, although construction emissions along the Caltrain corridor should be lower than these Central Valley segments.

As described in Section 3.2, *Air Quality*, the Proposed Project would have a significant impact on criteria pollutant emissions before mitigation for construction. However, with the implementation of Mitigation Measures AQ-2a through AQ-2c, the Proposed Project's criteria pollutant emissions would be reduced below the BAAQMD thresholds. Thus, the Proposed Project's contribution to potential cumulative impacts on air quality related to criteria pollutants would be reduced to a less-than-considerable level.

Toxic Air Contaminants

Construction of the Blended Service improvements and a portion of the HSR San Jose to Merced segment would occur along the Caltrain ROW with the possible exception of the maintenance yard (depending on location) and would result in toxic air contaminant emissions (in the form of diesel particulate matter (DPM)) due to construction equipment and vehicles.

Construction of other rail improvements and other cumulative projects along the Caltrain ROW could emit TACs (primarily in the form of DPM) that could impact public health of sensitive receptors along the Caltrain ROW. The TACs would be emitted from construction equipment and exhausts of workers' vehicles. The project-level environmental documents for the HST Merced to Fresno segment (CHSRA 2012d) and the HST Fresno-Bakersfield segment (CHSRA 2012e) both concluded that project construction TAC pollutants would be not be significant for alignment construction but would be significant for certain sensitive receptors close to a station or concrete batch plant. These impacts were found to be reduced to a less than significant level with project mitigation. A similar conclusion is likely for the construction of the San Jose to Merced HSR segment and the Blended Service improvements, although construction emissions along the Caltrain corridor should be lower than these Central Valley segments.

Therefore, the cumulative projects could have a potential significant cumulative impact on public health from TAC emissions on sensitive receptors along the Caltrain ROW.

As described in Section 3.2, *Air Quality*, the Proposed Project would not have a significant impact related to TAC/DPM emissions for construction. Implementation of Mitigation Measures AQ-2b through AQ-2c as mitigation for criteria pollutants would further reduce the Proposed Project's TAC/DPM emissions. Thus, the Proposed Project's contribution to potential cumulative impacts on air quality related to TAC/DPM emissions for construction would be less than considerable.

Operation

Criteria Pollutants

Blended Service

Operationally, HSR trains would not add any local criteria pollutant emissions due to train operation, since HSR trains would use electricity and not use diesel fuel. Indirect criteria pollutant

emissions would occur at power plants providing the electricity for HSR (depending on fuel source[12]), but such plants are highly regulated under state and federal law to be consistent with the air basin plans for areas in which they are located to not result in significant impacts to regional air quality. There would be some criteria pollutant emissions associated with maintenance yard operations and maintenance of HSR facilities as well as worker commutes, but such emissions are not expected to be substantial.

On a broader scale, Blended Service would offset vehicular and air travel criteria pollutant emissions for individuals choosing to take the high speed train for regional or state-wide travel instead of driving or flying. The Program EIS/EIR for the state-wide HST system (CHSRA 2005) concluded that statewide criteria pollutants would be reduced by 0.5 to 1.4 percent with the HST system compared with the No Project conditions overall.

All Other Projects

During operation of the other cumulative rail projects, there would be criteria pollutant emissions from diesel-based rail services such as ACE, Dumbarton Rail Corridor (DRC), Capitol Corridor, and Amtrak, as well as from freight rail. Due to federal regulations, emissions associated with diesel trains will dramatically decline over time which will reduce present and future emissions associated with rail service. Light-rail systems such as VTA's system are electrically powered and thus have no direct emissions, but have indirect emissions due to electricity provision. Both light and heavy-rail services provide alternatives to vehicular travel and freight rail provides an alternative to trucking and thus usually result in a net reduction in criteria pollutant emissions relative to vehicular travel or trucking. A similar conclusion applies to bus transit projects, like BRT or shuttles.

During operation of the cumulative highway projects, there may be an increase in vehicular emissions if such projects result in induced traffic. If such projects result in a net decrease in vehicle miles traveled (through high-occupancy vehicle lanes for example), then they would reduce criteria pollutant emissions. All major highway projects receiving federal funding must be consistent with the regional air quality plans.

During operation of the cumulative land use projects, there could be an increase in criteria pollutant emissions from increased vehicular travel. Over time, state and federal regulations are seeking to dramatically reduce the emissions of new vehicles through increased gas mileage as well as emission controls. Whether or not there will be an increase in criteria pollutant emissions due to land use development along the Peninsula corridor will depend on the rate of growth, vehicle technology, transit options, alternatives to vehicle travel such as bicycle use, and air quality regulation over time.

Proposed Project Cumulative Contribution

As discussed in Section 3.2, *Air Quality*, the Proposed Project would switch from diesel to electrically powered trains, and thus decrease the amount of criteria pollutants emitted during operation. In addition, by increasing service, the Proposed Project would provide increased alternatives to vehicle travel and thus reduce vehicle emissions as well. As a result, the Proposed Project's contribution to cumulative criteria pollutant impacts would be beneficial.

[12] CHSRA is exploring the potential to power the HSR with 100 percent renewable power (CHSRA 2013b).

Toxic Air Contaminants

Blended Service

Operationally, HSR operations would not add any DPM emissions along the Caltrain ROW due to train operation, since HSR trains would not use diesel fuel. There may be some diesel emissions associated with maintenance yard operations and maintenance of HSR facilities as well but the impact will depend on the proximity of the maintenance yard to sensitive receptors. The previously proposed Bayshore/Brisbane location is presently an industrial area that would be less sensitive than alternative locations that may be closer to residential areas, however this area is proposed to be converted to residential, commercial and other uses by the Brisbane Baylands project.

All Other Projects

During operation of the other cumulative rail projects, there could be increased DPM emissions from diesel-based rail services such as ACE, DRC, Capitol Corridor, AMTRAK as well as freight rail. Due to federal regulations, emissions associated with diesel trains will dramatically decline over time which will reduce present and future DPM emissions associated with rail service. Light-rail systems such as VTA's system are electrically powered and thus have no DPM emissions. Freight rail provides an alternative to trucking and thus can result in a net reduction in DPM emissions, although the location of the freight rail emissions (along the Caltrain ROW) and the displaced trucking (generally along freeways and major arterials) are different meaning that different sensitive receptors will have different impacts.

During operation of the cumulative highway projects, there may be an increase in truck DPM emissions if such projects result in induced truck traffic. Due to federal regulations, emissions associated with diesel trucks will also dramatically decline over time which will reduce present and future DPM emissions associated with trucking.

During operation of most cumulative land use projects, substantial TAC or DPM emissions are not expected as most residential and commercial traffic is presently with gasoline vehicles which do not result in substantial TAC/DPM emissions. However, materials delivery to such development will be via truck, most of which are diesel trucks and thus some minor increases in DPM emissions will also occur (although truck DPM emissions will decline over time due to regulation).

Proposed Project Cumulative Contribution

As discussed in Section 3.2, *Air Quality*, the Proposed Project would switch from diesel to electrically powered trains, and thus decrease the amount of TAC/DPM pollutants emitted during operation, thus improving health conditions along the entire Caltrain corridor between San Jose and San Francisco. As a result, the Proposed Project's contribution to cumulative TAC impacts would be beneficial.

4.1.4.4 Biological Resources

Impact CUMUL-3-BIO: Cumulative effects on biological resources

This analysis focused on potential cumulative loss of sensitive biological resources, which is defined as including special-status species, riparian habitats or other sensitive natural communities, protected wetlands or waters, and wildlife migration or nursery sites. This analysis also examines

potential cumulative conflicts with local biological protection ordinances or adopted habitat conservation plans.

The geographic context for the analysis of cumulative biological resources impacts includes the Caltrain ROW and immediate vicinity. For potential impacts to terrestrial species, the Caltrain ROW is the geographic context and for aquatic species the geographic context includes the streams traversed by the ROW and downstream. The cumulative projects included in this cumulative analysis include all projects listed in Table 4-3.

Construction

As discussed in Section 3.3, *Biological Resources*, the Caltrain ROW is primarily an urban and suburban rail corridor with only limited areas of sensitive biological habitat. Construction of HSR San Jose to Merced and Blended Service improvements along the Caltrain corridor could potentially affect the same biological resources affected by the Proposed Project. Blended Service improvements construction could also affect biological resources not affected by the Proposed Project due the maintenance yard (depending on location). Additional tree removal may also need to occur for the San Jose to Merced construction and where Blended Service passing tracks are located outside of existing Caltrain tracks for the additional OCS and ESZ for those passing tracks. Aquatic habitat could also be degraded from an increase in erosion and sedimentation during construction.

The project-level environmental documents for the HST Merced to Fresno segment (CHSRA 2012d) and the HST Fresno-Bakersfield segment (CHSRA 2012e) both concluded that project construction impacts to biological resources would be significant before mitigation, but could be reduced to a less than significant levels with project mitigation. A similar conclusion is likely for construction of the San Jose to Merced and Blended Service improvements, although given the urban/suburban nature of the Caltrain Corridor, there are far less areas of biological sensitivity potentially affected along the Caltrain ROW and thus impacts would be less than on the Central Valley segments (or on natural lands crossed by the San Jose to Merced HSR segment).

Construction activities for other cumulative projects could also result in the loss of biological resources due to grading, paving and tree removal where sensitive biological resources are present. Aquatic habitat could be degraded from an increase in erosion and sedimentation during construction. However, in most cases, project-level mitigation will be able to reduce impacts to a less than significant level.

As described in Section 3.3, *Biological Resources*, the Proposed Project could have significant impacts to special-status species, riparian habitats or other sensitive natural communities, protected wetlands or waters and to trees along the Caltrain ROW without mitigation. However, with implementation of Mitigation Measure BIO 1a-1h (special-status species), BIO-2 (sensitive natural communities), BIO-3 (wetlands and waters), BIO-5 (tree avoidance, minimization, and replacement) and BIO-6 the Proposed Project's project-level impacts on biological resources due to construction would be reduced to a less-than-significant level. The Proposed Project construction would not occur in pristine areas, but, rather, in a developed rail corridor; thus, impacts would be to remnant biological resources within that context. Given that context, with mitigation, the Proposed Project's residual construction impacts would be limited in scale and extent. Consequently, Proposed Project construction, with mitigation, would make a less than considerable contribution to any potential cumulative impacts on biological resources due to construction.

Operation

Blended Service

While increased train traffic would occur with HSR operations and the Proposed Project, operational conditions are not expected to be significantly different from pre-project conditions relative to biological resources. Routine tree maintenance would be conducted along the Caltrain ROW for all areas where OCS clearance is required, but these activities would be similar to existing maintenance practices albeit they would be conducted in more expansive areas and more frequently than at present.

HSR tracks south of Diridon for the San Jose to Merced segment and additional station space at Diridon, Millbrae, and potentially Redwood City would require additional impervious spaced which would result in additional runoff generation. In addition, a new maintenance facility would also have new impervious spaces as well as the operational use of fuels and other materials. Any new facilities would need to comply with applicable state and federal water quality requirements concerning stormwater runoff and control of fuels and other materials with potential to pollute downstream waters.

All Other Projects

For the most part, impacts to biological resources along the Caltrain corridor from the cumulative projects would occur during the construction phase; however there could be new impacts related to operations of some of the cumulative projects. Where development occurs on existing vacant sites, there could be increases in the stormwater runoff which could degrade water quality in surface waters downstream of the Caltrain ROW corridor and affect aquatic species. However, current water quality regulations implemented through the countywide stormwater NPDES permits requires treatment of stormwater runoff for substantial new projects precisely to manage the cumulative impact on water quality of new development in the corridor. Some of the projects may also handle fuel or other hazardous materials.

Proposed Project Cumulative Contribution

As described in Section 3.3, *Biological Resources*, the Proposed Project could have significant impacts to nesting bird or bat species during tree maintenance along the Caltrain ROW without mitigation. However, with implementation of Mitigation Measure BIO-1j, impacts due to disruption of bird nesting or bat roosting would be reduced to a less-than-significant level. The additional permanent project facilities (traction power substations, switching station, and paralleling stations) would have limited areas of new impervious surfaces that would result in limited increases in stormwater generation potential. As discussed in Section 3.9, *Hydrology and Water Quality*, these facilities would comply with the respective countywide stormwater programs, which would result in less-than-significant indirect impacts on the water quality and hydrology of waters and wetlands. Consequently, with mitigation Proposed Project operation would make a less-than-considerable contribution to potential cumulative impacts on biological resources due to operations.

4.1.4.5 Cultural Resources

Impact CUMUL-4-CUL: Cumulative effects on cultural resources

Methodology

Historical Resources

The geographical context area for architectural historical resources was defined to include the area directly adjacent to the Caltrain ROW, the parcels surrounding the proposed traction power facility sites and the Caltrain ROW. The project APE/study area includes a variety of historical structures considered historic resource under CEQA and eligible for the national or California registers. Table 3.4-3 in Section 3.4, *Cultural Resources*, lists the 25 eligible and listed properties within Proposed Project APE. Cumulative projects within this geographic context include all projects within and adjacent to the Caltrain ROW. An adverse change to an eligible and listed property in the NRHP and CRHR during the construction phase of a cumulative project could result in significant cumulative impacts on historical archeological resource.

Archaeological Resources

The geographic context for the analysis of potential cumulative impacts on archeological resources includes areas where cumulative projects overlap with the Proposed Project to affect a single resource. Present and probable future cumulative projects within this geographic context include all projects within and adjacent to the Caltrain ROW. If known or unknown archeological resources are disturbed, the identified cumulative projects could result in significant cumulative impacts on archaeological resources.

Human Remains

The geographic context for the analysis of potential cumulative impacts on human remains includes areas where cumulative projects overlap with the Proposed Project site to affect a single resource. Present and probable future cumulative projects within this geographic context include all projects within and adjacent to the Caltrain ROW. If known or unknown human remains are disturbed, the identified cumulative projects could result in significant cumulative impacts on a cultural resource.

Construction

Historic Resources

Construction of the HSR improvements would include improvements at the Diridon Station and Millbrae Station, both of which are NRHP and CRHP listed structures. In addition, it is possible that there may be historic resources (including historic buildings as well as any historic tree groves if present) located in areas ultimately proposed for passing tracks or a maintenance yard (or possibly for other improvements like grade separations) that might be affected by HSR construction.

Some of the other cumulative projects (including projects Nos. 4, 5, 12, 16, 30, 57, 67, 68, 69, and 72) could also affect historic Caltrain stations at Millbrae, San Carlos, Atherton, Menlo Park, Palo Alto, Santa Clara, and San Jose or historic underpassings. The San Mateo Bridge Project will remove and replace the four historic underpasses in San Mateo and, thus, the Proposed Project would not have an effect on those underpasses because they will be removed by another project prior to the

completion of the Proposed Project. If freight rail service requires additional height clearances, modifications could affect historic railroad tunnels in San Francisco as well as the historic bridge over San Francisquito Creek.

While cumulative projects may affect other historic resources away from the Caltrain ROW, the Proposed Project would not affect such resources and thus such resources are not discussed further in this analysis.

There could be significant cumulative impacts to the historic resources noted above.

As discussed in Section 3.4, *Cultural Resources*, the implementation of Mitigation Measures CUL-1a through CUL-1f would reduce the Proposed Project's effects on historic tunnels, stations, and underpasses along the Caltrain ROW with the possible exception of San Francisco Tunnel 4. While other cumulative projects may have significant impacts on the same historic resources affected by the Proposed Project and their impact may or may not be mitigable, the Proposed Project's residual impacts on these resources after Proposed Project mitigation would be minimal, except possibly at Tunnel 4. Therefore, the Proposed Project's potential contribution to cumulative impacts on historical resources due to construction would be less than considerable.

Archaeological Resources

Based on the cultural resource evaluation for the Proposed Project, construction of the HSR San Jose to Merced segment and Blended Service improvements along the Caltrain ROW could impact archeological resources in the City of San Francisco, City of San Jose, and identified sensitive archeological zones in or adjacent to the study area and within the Caltrain ROW. Blended Service improvements construction could also affect other archeological resources at the maintenance area or in passing track locations outside the Caltrain ROW.

During construction, earth moving activities for other cumulative projects in or adjacent to the Caltrain ROW could also impact archaeological resources that may be affected by the Proposed Project. An overlap in the construction area for some of these projects increases the likelihood of finding unknown or impacting known archeological resources. Construction activities for cumulative projects that are not adjacent to the Caltrain ROW could impact archeological resources but the site disturbance areas for these projects would not overlap with Proposed Project.

Thus, there is a potential for cumulative impacts on archaeological resources due to potential multiple disturbances of resources that may be encountered in or along the Caltrain ROW.

As discussed in Section 3.4, *Cultural Resources*, the implementation of Mitigation Measures CUL-2a, CUL-2b, CUL-2c, CUL-2d, CUL-2e, and CUL-2f would reduce the Proposed Project's effects on archaeological resources along the Caltrain ROW to a less-than-significant level. While other cumulative projects may have significant impacts on the same archaeological resources affected by the Proposed Project, the Proposed Project's residual impacts on these resources after Proposed Project mitigation would be minimal. Therefore, the Proposed Project's potential contribution to cumulative impacts on archaeological resources due to construction would be less than considerable.

Human Remains

Construction activities for the cumulative projects could impact human remains and result in cumulative impacts where project disturbance areas overlap. However, with implementation of

Mitigation Measures CUL-3, the Proposed Project's contribution to any potential cumulative impacts on human remains would be less than considerable.

Operation

For the most part, cumulative projects would not require further ground disturbance or disturbance to historic structures after construction. As discussed in Section 3.4, *Cultural Resources*, the Proposed Project would have no impact on cultural resources during operations. Therefore, there would be no cumulative cultural resource impacts resulting from Proposed Project operation, and the Proposed Project would make no contribution to any impact.

4.1.4.6 EMF/EMI

Impact CUMUL-5-EMF: Cumulative increase in electromagnetic fields or electromagnetic interference

The geographic context for the analysis of potential cumulative impacts of electromagnetic fields (EMF) and electromagnetic interference (EMI) includes the Caltrain ROW and the area adjacent to the Caltrain ROW.

The only cumulative projects that could change EMFs in this area are electrified rail projects including: Blended Service (#1), San Jose – Merced High Speed Train (#2), Caltrain Full Electrification (#3), BART Silicon Valley (#8), BART Millbrae Tail Tracks (#70), Central Subway (#13), the re-routing of the 22-Fillmore trolley (#14) and several light-rail projects (#16). Land development projects would not involve substantial generation of EMFs at concern levels but may introduce new receptors along the Caltrain ROW.

The concern with EMFs is potential health risks to receptors along the Caltrain ROW. The concern with EMI is potential interference with sensitive electrical equipment along the Caltrain ROW due to increased EMF levels.

Construction

Construction activities from cumulative projects along the Caltrain ROW would temporarily increase the amount of EMF. As discussed in Section 3.5, *Electromagnetic Fields and Electromagnetic Interference*, all construction equipment generates a small amount of EMF but not at levels considered to be a potential health risk concern. As a result, cumulative EMF/EMI impacts resulting from construction would be less than significant, and the contribution of the Proposed Project would be less than considerable.

Operation

The location of potential cumulative increases in EMF levels along the Caltrain ROW due to cumulative projects are as follows:

- Proposed Project: from south of Tamien Station to San Francisco (AC EMF field, 60 Hz).
- Blended Service and HSR San Jose to Merced: San Jose (from 2 miles south of Tamien Station) to San Francisco (AC EMF field, 60 Hz).
- Caltrain Full Electrification: San Jose to San Francisco (due to larger number of electrified trains) (AC EMF field, 60 Hz).

- BART Silicon Valley: San Jose to Santa Clara (DC EMF field).
- BART Millbrae Tail Tracks: 200–300 feet south of the current BART yard in Millbrae (DC EMF field).
- Central Subway Project: near the San Francisco 4th and King station (~~surface effects attenuated by being underground~~ due to additional light trains on surface streets) (DC EMF field).
- Re-routing of the 22- Fillmore trolley: along 16th Street (DC EMF field).
- Extension of the MUNI T-Line: near the Caltrain Bayshore Station (DC EMF field).
- Tasman Express Long T double-tracking: near the Mountain View Caltrain Station (due to additional light rail trains) (DC EMF field).
- Mineta San Jose International Airport APM Connector: near the Santa Clara Caltrain Station (unknown design; unknown EMF field generation).

As noted above, only some of the cumulative projects use alternating current (AC) systems and generate AC EMF fields like the Proposed Project. Cumulative projects that use direct current (DC) systems generate static DC EMF fields, which have higher health thresholds than those for variable AC EMFs. As described in the final EIS for the BART Silicon Valley Extension, because BART uses DC traction power, contributions from BART to the magnetic field levels of the ambient power frequency (60 Hz AC) were described as negligible (VTA 2010). Thus, EMFs from DC systems should not be simply added to those from AC systems and compared with a single standard. Instead, one should compare DC EMF levels with DC thresholds and AC EMF levels with AC thresholds. Because the Proposed Project OCS would have an AC system, the focus of this cumulative analysis in regards to health concerns is on potential cumulative EMF impacts from AC systems.

For HSR San Jose to Merced operations and Blended Service from San Jose to San Francisco, potential EMF levels associated with HSR can be estimated based on assessment of other sections of the HSR project. In the Final EIR/EIS for the Merced to Fresno segment of the HSR project, the EMF levels were estimated. When the California HSR project is complete, the predicted HSR-generated EMF/EMI levels to which the general public is expected to be exposed would be lower than the applicable HSR project Maximum Permissible Exposure (MPE) standards[13] for humans in uncontrolled (open) environments used for HSR evaluations. Specifically, it was estimated that fenceline EMF levels would be 177 milligauss (mG) (CHSRA 2012d). As described in Section 3.5, *Electromagnetic Fields and Electromagnetic Interference*, the Proposed Project's EMF levels along the Caltrain ROW were estimated at up to 41 mG. With full electrification, EMF levels for Caltrain electrified service could increase by perhaps 25 percent. The EMF levels along the fenceline for Blended Service should be well below the threshold used in this EIR of 833 mG. Thus, the Proposed Project would make a less than considerable contribution to potential health risks associated with EMFs.

Concerning EMI, the projects specified above could also result in interference with electrical equipment along the Caltrain ROW. Both DC and AC systems could contribute to potential interference concerns.

For HSR service, analysis in the Fresno to Bakersfield Revised Draft EIR/EIS (CHSRA 2012e) was used to examine potential HSR EMI impacts. In that document, potentially significant impacts were

[13] The CHSRA Merced-Fresno EIR/EIS (CHSRA 2012d) MPE for the EMF health risks for the general public are the same as the EMF thresholds used in this EIR: 833 mG for magnetic fields and 4.2 kV/m for electrical fields.

identified where the HSR route crossed adjacent to at least one facility with sensitive equipment such as medical imaging systems and mitigation was proposed that would lower potential EMI impacts to a less than significant level.

Prior to mitigation, there is the potential for cumulative EMI effects due to HSR Service, the Proposed Project and other projects. As discussed in Section 3.5, *Electromagnetic Fields and Electromagnetic Interference*, the Proposed Project was identified as having potentially significant EMI impacts on sensitive equipment and adjacent freight and passenger rail system signals and equipment, and Mitigation Measure EMF-2 would require system design to minimize EMI effects and to coordinate with adjacent facilities with potential sensitive equipment and with freight and passenger rail operators.[14] With implementation of Mitigation Measure EMF-2, the Proposed Project's contribution to any potential cumulative EMI effects would be reduced to a less-than-considerable level.

4.1.4.7 Geology, Soils and Seismicity

Impact CUMUL-6-GEO: Cumulative exposure of people or structures to geologic or seismic hazards or destruction of unique paleontological/geologic resources

Geology and soil-related impacts are typically site-specific and depend on the local geologic and soil condition. The geographic context for the analysis of cumulative construction geologic, soil, and paleontological resource impacts includes areas within and adjacent to the Caltrain ROW. Past, present, and probable future cumulative projects within this geographic context include the projects listed in Table 4-3 that are within the Caltrain ROW or adjacent.

Construction

Construction impacts are limited to the potential for increased erosion and potential damage to paleontological resources. Impacts related to other geological, seismic, and soil hazards for new structures are discussed under operations.

Erosion

Construction of cumulative projects could result in cumulative erosion impacts unless controlled. All major projects, including the Proposed Project, must comply with the Construction General Permit NPDES, which requires substantive controls on project erosion such that significant cumulative impacts due to erosion are not expected. Therefore, the Proposed Project's contribution to potential cumulative erosion impacts would be less than considerable.

Paleontological Resources/Unique Geologic Features

Cumulative construction projects may encounter paleontological resources. However, as discussed in Section 3.6, *Geology, Soils and Seismicity*, the Caltrain ROW and adjacent areas are highly disturbed urban areas that are unlikely to contain intact unique geologic or paleontological features. In addition, the below-ground disturbance associated with the Proposed Project is limited overall in extent. Consequently, the potential for the Proposed Project to contribute to potential cumulative impacts on paleontological resource or unique geologic features is less than considerable.

[14] Similar mitigation may be required for Blended Service.

Operation

New transportation, residential, commercial and other facilities and services could increase exposure of people or structures to geologic, seismic and soil hazards could result in a significant cumulative impact. The project area is likely to experience a strong seismic activity and geologic instability (e.g., soil liquefaction or collapse) that could damage structures or expose people to greater risks of loss of life and injury. In addition, there could be cumulative exposure due to construction in areas of expansive soils. Therefore, there could be a significant cumulative impact from the increase exposure of structures and people to risks and damage associated with geologic, seismic and soil hazards. All cumulative projects would be subject to comply with applicable state and local codes, including design standards (e.g., California Building Code), which address these impacts.

As discussed in Section 3.6, *Geology, Soils and Seismicity*, the Proposed Project could also result in various impacts related to geologic, seismic or soil hazards. With implementation of Mitigation Measures GEO-1, 4a, and 4b would reduce the Proposed Project's exposure to risks of geologic, seismic and soil hazards. Therefore, the Proposed Project's contribution to the increase of exposure to these hazards would be less considerable.

4.1.4.8 Greenhouse Gas Emissions and Climate Change

Impact CUMUL-7-GHG: Cumulative greenhouse gas emissions or exposure of people or structures to reasonably foreseeable impacts of climate change

The geographic context for the analysis of cumulative construction and operation related impacts to greenhouse gas emissions is the planet. All of the projects in Table 4-3 are included in the analysis as well as cumulative GHG emissions from California, the United States, and the rest of the world.

For the analysis of potential exposure of people or structures to reasonable foreseeable impacts of climate change, the geographic context is the San Francisco Peninsula and is only analyzed for operational conditions. Past, present, and probable future cumulative projects within this geographic context consist of all projects listed in Table 4-3.

Greenhouse Gas Emissions

During construction, all cumulative projects would emit GHGs due to construction equipment and vehicles. Construction activities are temporary, but the lifespan of the most emitted greenhouse gas, carbon dioxide, can be up to 100 years and many of the other GHGs can last for decades.

HSR Operations

Operationally, HSR would not add any GHG direct local emissions due to train operation, since HSR trains would use electricity and not use diesel fuel. Indirect GHG emissions would occur at power plants providing the electricity for HSR. There will also be some GHG emissions associated with maintenance yard operations and maintenance of HSR facilities as well as worker commutes, but such emissions are not expected to be substantial. On a broader scale, HSR service would offset vehicular and air travel GHG emissions for individuals choosing to take the high speed train for regional or state-wide travel instead of driving or flying. The effects of high-speed rail service on GHG emissions were estimated by considering the GHG analysis in the Final EIS/EIR for the Merced –Fresno HSR segment (CHSRA 2012d), which concluded that operational GHG emission reduction in

the segment region (due to car and plane trips removed in the Merced-to-Fresno area) would offset segment construction GHG emissions within less than six months. Overall, the statewide HST system, with Phase 1 blended system operations would result in reductions of 0.79 to 1.40 million metric tons of CO2e in 2029 and 1.15 to 1.85 million MT CO2e in 2035 (CHSRA 2013b).

All Other Projects

During operation of the other cumulative rail projects, there would be GHG emissions from diesel-based rail services such as ACE, DRC, Capitol Corridor, and Amtrak, as well as from freight rail. Light-rail systems such as VTA's system are electrically powered and thus have no direct GHG emissions, but have indirect GHG emissions due to electricity provision. Both light and heavy-rail services provide alternatives to vehicular travel and freight rail provides an alternative to trucking and thus usually result in a net reduction in GHG emissions relative to vehicular travel or trucking. A similar conclusion applies to bus transit projects, like BRT or shuttles.

During operation of the cumulative highway projects, there may be an increase in vehicular GHG emissions if such projects result in induced traffic. If such projects result in a net decrease in vehicle miles traveled (through high-occupancy vehicle lanes for example), then they would reduce GHG pollutant emissions.

During operation of the cumulative land use projects, there could be an increase in GHG pollutant emissions from increased vehicular travel as well as building energy consumption, waste generation, water and waste treatment and other sources. Over time, local, state and federal plans are seeking to dramatically reduce GHG emissions overall. Many of the communities along the San Francisco Peninsula have adopted local Climate Action Plans to reduce GHG emissions under their control and AB 32 mandated GHG emission reductions at a state level. According to the state's latest inventory data, the state is on track to reduce GHG emissions by 2020 to 1990 levels.

Proposed Project Cumulative Contribution

As discussed in Section 3.7, *Greenhouse Gas Emissions and Climate Change*, the Proposed Project would switch Caltrain from diesel to electrically powered trains, and, thus, decrease the amount of GHG emissions during Caltrain operation. In addition, by increasing service, the Proposed Project would provide increased alternatives to vehicle travel and thus reduce vehicle GHG emissions as well. While the Proposed Project would result in GHG emissions during construction, it is expected that the operational reduction of GHG emissions would offset the construction GHG emissions within less than one year and the Proposed Project would result in a net reduction of GHG emissions. As a result, the Proposed Project's contribution to cumulative GHG emissions would be beneficial.

Exposure of People or Structures to Reasonably Foreseeable Impacts of Climate Change (other than Sea Level Rise)

As discussed in Section 3.7, *Greenhouse Gas Emissions and Climate Change*, even with the efforts of the municipalities along the San Francisco Peninsula, in the greater San Francisco Bay Area, and in California as a whole, a certain amount of climate change is unavoidable due to existing and unavoidable future GHG emissions. With respect to central western California, including the project site, climate change effects could be substantial including, but not limited to hotter and drier climates, more frequent and intense wildfires, changes in water supplies, and a number of other effects.

All of the cumulative projects would be subject to some of the potential impacts related to climate change in the future whether it is temperature increases, changes in storm characteristics, or wildfire potential though individual effects will depend on the nature of project, use by people, location and vulnerability to climate change effects.

As described in Section 3.7, *Greenhouse Gas Emissions and Climate Change*, with the exception of sea level rise, the Proposed Project is not expected to result in increased risk to people or structures from foreseeable climate change effects.

Risks due to flooding associated with sea level rise are addressed separately in discussion of Hydrology and Water Quality below.

4.1.4.9 Hazards and Hazardous Materials

Impact CUMUL-8-HAZ: Cumulative effects related to hazards and hazardous materials

Potential hazard impacts are generally site specific and thus the geographic context for the analysis of cumulative hazards impacts includes the Caltrain ROW and the adjacent area. Hazards relative to hazardous materials and emergency response/evacuation are analyzed for both construction and operations. Hazards relative to airports and ~~wildand~~ wildland fire are only analyzed for operations. Past, present, and probable future cumulative projects within this geographic context consist of all cumulative projects listed in Table 4-3 that are adjacent to the Caltrain ROW.

Construction

Hazardous Materials

During construction of cumulative projects, people could be exposed to a risk to human health and spillage of hazardous materials such as gasoline, oil paint and solvents could. Water quality contamination could occur from accidental spillage of hazardous materials and mixture of contaminated water with non-contaminated water. Excavation activities could expose construction crew members to hazardous materials that could pose a risk to health and safety.

Some of the cumulative projects are proposed in areas with known existing contamination. Several examples are described below (not a comprehensive list of sites with known contamination):

- The previously considered location for a HSR maintenance yard at the Brisbane/Bayshore location is a former landfill with known contamination.
- The Brisbane Baylands Specific Plan which is proposed in part at the same location previously considered for a HSR maintenance yard also contains known contamination from a former landfill, railroad yard, and industrial activity.
- The 395 Page Mill Road Project in the City of Palo Alto is proposed on a contaminated site undergoing remediation for contaminated soil and groundwater.

These are only a few examples; other project may also encounter contamination issues. Thus, the construction of cumulative projects would have cumulative significant impact related to hazardous conditions and exposure to hazardous materials.

The construction of HSR San Jose to Merced and Blended Service improvements would encounter similar hazardous materials conditions as that described for the Proposed Project for the Caltrain

ROW, however hazardous material conditions could be different for the maintenance yard, depending on location. The previously considered maintenance yard site in Brisbane has contamination issues due to its former industrial use. The greatest amounts of excavation for the Blended Service improvements (when hazardous material is more likely to be encountered) would be for station improvements, passing tracks and the maintenance yard.

As discussed in Section 3.8 *Hazards and Hazardous Material*, contaminated soil and groundwater may be encountered during Proposed Project construction. In addition, construction would involve use of petroleum and other hazardous materials. Compliance with local, state and federal regulations for handling of materials and implementation of the mandatory Stormwater Pollution prevention Plan will address impacts associated with construction handling of petroleum and other materials. For encountered contamination, the Proposed Project would require implementation of Mitigation Measures HAZ-2a and HAZ-2b, which require preconstruction investigation of potentially contaminated areas and appropriate containment, handling and disposal of any encountered contaminated soil and groundwater. While multiple cumulative projects will handle petroleum and hazardous materials and are likely to encounter existing soil and groundwater contamination present in and adjacent to the Caltrain ROW, the existing regulatory requirements place strict controls on how such materials are handled and how contamination is to be addressed. Thus, the Proposed Project's contribution to any potential cumulative impact related to hazardous materials during construction would be reduced to a less-than-considerable level with the implementation Mitigation Measures HAZ-2a and HAZ-2b.

Emergency Response/Evacuation

During cumulative project construction, there may be temporary obstruction of access and egress from construction sites and on adjacent roads due to construction. Such obstruction would affect the ability of emergency responders to timely reach their destinations and impede the ability to evacuate constrained areas in the event of an emergency. Where one or more cumulative projects would be in construction at the same time in the same area, there could be cumulative impacts on emergency response or evacuation capacity.

As discussed in Section 3.8, *Hazards and Hazardous Materials*, the Proposed Project could have such effects if an emergency occurs at the time when the Proposed Project construction limits access to the Caltrain ROW or at at-grade crossings. As described in Section 3.14, *Transportation and Traffic*, Mitigation Measure TRA-1a will require the preparation of a traffic control plan to help ensure continued emergency access to Caltrain ROW, at-grade crossings, and all nearby properties. Caltrain would coordinate with local public works departments, local emergency providers, and Caltrans in the development of the traffic control plan to specifically address emergency response concerns. Potential issues associated with multiple projects in construction at the same time may be addressed through development of the traffic control plan. Thus, with mitigation, the Proposed Project's contribution to a potential cumulative impact related to emergency response or evacuation would be less than considerable.

Operation

Hazardous Materials

Release of and exposure to hazardous materials during operation of cumulative projects could result in a cumulative significant impact. Because both HSR service and the Proposed Project would involve electrically powered trains, spills of diesel petroleum products would not occur during

operation. However, operation of HSR service and the Proposed Project would involve handling of hazardous materials including batteries in EMUs, fluids in transformers and other electrical equipment, and maintenance materials and cleaning fluids.

Operation of the other cumulative projects would also involve the use and handlings of petroleum and other hazardous materials including during maintenance. The use and handling of such materials is highly regulated by local, state, and federal requirements that are applicable universally. Therefore, routine operation and maintenance of the cumulative projects is not likely to have a significant cumulative impact from the release of or exposure to hazardous materials. There is always the possibility of an unforeseen accident involving petroleum or other hazardous materials, but local, state, and federal regulations also specify operating procedures to minimize the potential for such accidents and remedial response necessary in the event of such accidents or spills to contain and cleanup hazardous material releases.

As discussed in Section 3.8, *Hazards and Hazardous Materials,* the Proposed Project would comply with all applicable regulations concerning use, handling, storage, and disposal of petroleum and hazardous materials. Further, with the substantial reduction in diesel fuel use, the potential for diesel spills with the Proposed Project would be far lower than the existing potential for spills during current operations and maintenance.

~~Although the Proposed Project would increase the amount of trains on the Caltrain corridor, conflicts with freight trains would be managed through temporal separation (pursuant to the current FRA waiver requirements), through train scheduling and dispatch, and with the use of Positive Train Control enabled by the CBOSS PTC project to minimize the potential for conflicts (if the FRA waiver is modified to allow blending of EMUs and freight traffic).~~

Although the Proposed Project would increase the amount of trains on the Caltrain corridor, conflicts with freight trains would be managed through train scheduling and dispatch, and with the use of Positive Train Control enabled by the CBOSS PTC project to minimize the potential for conflicts.

Thus, Proposed Project operations would result in a less-than-considerable contribution to any potential cumulative impacts related to hazardous materials.

Locations Relative to an Airport Land Use Plan

There are a number of airports along the Caltrain corridor, specifically, San Francisco International, Mineta San Jose International, the federal airfield at Moffett Field, and municipal airports at San Carlos and Palo Alto. Cumulative projects could result in potential hazards if they propose elevated structures within the safety prism for landing and departing aircraft or if they place substantial numbers of people within safety zones around the airports that might be subject to injury or death in the event of a near-airport plane emergency landing or crash. Blended Service improvements may include elevated structures north of the San Jose Diridon Station (if an aerial station is selected) that will need to be designed to avoid encroachment in safety zones of the San Jose International Airport. Blended Service improvements at the Diridon Station, Millbrae Station and possibly at the Redwood City Station would be sufficiently far from nearby airports that they are unlikely to result in any safety zone encroachments. While the location of a potential HSR maintenance yard is unknown, it is not likely to have substantially elevated structures that would be likely to conflict with safety zone requirements.

As discussed in Section 3.8, *Hazards and Hazardous Materials*, the Proposed Project's TPFs and the OCS would not conflict with any airport land use plan or airport safety zones. Thus, the Proposed Project would result in a less-than-considerable contribution to any potential cumulative impacts on airport land use plans or airport safety zones.

Emergency Response/Evacuation

Cumulative projects would affect existing emergency response times or evacuation capacity if they result in constrictions on the ability for emergency responders to reach their destinations or the egress ability from constrained areas in the event of an emergency. This could occur due to physical constraints and/or generation of traffic congestion which could impede emergency vehicles.

As discussed below in the analysis of cumulative transportation and traffic impacts, the increase of cumulative rail traffic along the Caltrain ROW from HSR, ACE, Capitol Corridor, Amtrak and freight could result in increased gate-down times at the at-grade crossings along the Caltrain ROW. Because of cumulative growth in traffic over time due to the land development projects included in Table 4-3 and general growth in the region, traffic conditions are expected to substantially decline over the next few decades at the at-grade crossings of the Caltrain ROW and generally throughout the region (in spite of substantial investments in transit). With this cumulative growth in traffic, emergency response times during peak hours may be adversely affected, as could the ability to evacuate areas via vehicles.

An additional cumulative concern with cumulative travel demand growth over time and increased transit service for HSR, BART, VTA, Muni, SamTrans, and Caltrain is that transit stations, especially underground stations, will exceed their currently designed capacity to allow for safe egress in the event of an emergency. BART, for example, in its scoping comment letter on the Proposed Project, specifically noted that several segments of the BART system, especially downtown San Francisco stations, are currently near capacity. Thus cumulative travel demand could result in significant impacts on evacuation plans for transit stations with constrained egress conditions, especially underground transit stations.

As discussed in Section 3.14, *Transportation and Traffic*, the Proposed Project would result in significant increases in traffic delays at a number of at-grade crossings along the Peninsula corridor due to increased gate-down time during peak hours. The Proposed Project would also impact traffic near some of the Caltrain stations. Project mitigation measure (described in Section 3.14, *Transportation and Traffic*) would reduce traffic impacts at many locations and would include requirements for coordination with local emergency providers to minimize increase in response times as feasible but would not reduce all traffic delays to a less-than-significant level.

Emergency response times are function of the conditions between the responder base location and the incident location overall, not only a function of conditions at any one point along the response path. As discussed in Section 3.14, *Transportation and Traffic*, the Proposed Project overall would substantially reduce overall vehicle miles traveled (VMT) in the Peninsula corridor by approximately 235,000 miles/day in 2020 and 619,000 miles/day in 2040 (compared with No Project conditions), which would substantially improve congestion on a broad general basis. Most of the VMT reductions would be during peak hours, which is especially important in reducing congestion. The broad-based congestion improvement is expected to more than offset the localized effects on at-grade crossings and near Caltrain stations and result in a net improvement (compared with No Project conditions) in the emergency response times and in the ability to evacuate

constrained areas by vehicle. Thus, the impact on emergency response times would be less than significant.

As discussed in Section 3.8, *Hazards and Hazardous Materials*, the Proposed Project's new OCS would not pose an impediment to routine emergency equipment access.

Regarding transit stations emergency evacuation, as discussed in Section 3.14, *Transportation and Traffic*, the Proposed Project is not expected to substantially increase the ridership of other transit systems on the Peninsula. In specific, relative to No Project conditions, the Proposed Project is expected to result in a slight decrease in BART ridership, a slight increase in Muni Metro (rail) ridership in 2020 but a slight decline in 2040, and a slight increase in VTA light rail ridership. As a result, station evacuation would be primarily a concern for controlled access BART stations and underground Muni Metro stations. There is less concern for evacuation from at-grade Muni Metro and VTA light-rail stations and all bus stations and stops given the open architecture of such facilities. While some BART and underground Muni Metro stations may reach capacity because of cumulative transit ridership, the Proposed Project would not contribute considerably to potential cumulative impacts related to evacuation capacity at these locations because the Proposed Project's long-term effect on these systems (e.g., in 2040) would be a slight reduction in ridership.

Wildland Fires

The Caltrain ROW and adjacent areas are highly developed urban and suburban areas with very few areas of adjacent wildlands. The only areas of wildlands along the Caltrain ROW are San Bruno Mountain and Communications Hill in San Jose. Cumulative projects adjacent to wildland areas might result in increased wildland fire risk by either placing activities with greater potential to ignite wildfires or by placing increased numbers of people and structures adjacent to wildland areas that might be subject to wildland fires. As discussed in Section 3.8, *Hazards and Hazardous Materials*, the Proposed Project is not located in any high fire risk areas and the Proposed Project would maintain an electrical safety zone around all its electrical equipment to minimize the risk of fires due to contact with live electrical wires. While cumulative projects might increase the risk or consequence of wildland fires, the Proposed Project's contribution to any potential cumulative impact regarding wildlife fires would be less than considerable.

4.1.4.10 Hydrology and Water Quality

Impact CUMUL-9-HYD: Cumulative impacts related to hydrology and water quality

The geographic context for the analysis of cumulative construction and operation-related hydrology and water quality impacts consists of the Caltrain ROW and adjacent areas, and downstream areas. Past, present, and probable future cumulative projects within this geographic context consist of all projects listed in Table 4-3. The focus of the construction analysis is on water quality. The operational analysis of impacts includes water quality, groundwater recharge, drainage patterns and flooding.

Construction

Earth moving activities from cumulative projects such as grading and excavating could degrade water quality from an increase in sediment-load, alteration to drainage patterns and increased surface runoff. During construction, earth moving activities could degrade the water quality of streams that cross the Caltrain ROW as well as San Francisco Bay downstream. In addition, during

excavation activities, shallow groundwater could be degraded from the introduction of sedimentation and spillage of construction hydraulic fluid and there is also the potential of release of contaminated groundwater during dewatering activities. Construction activities for many of cumulative projects listed in Table 4-3 would each involve earth moving activities that collectively would impact on water quality. All major projects (with disturbance of more than 1 acre) are required to comply with the Construction General NPDES Permit which mandated preparation of a Stormwater Pollution Prevention Plan (SWPPP) to address all of the above water quality concerns. While smaller projects are not required to comply with the Construction General NPDES Permit, it is routine practice for local jurisdictions to require erosion and sedimentation at all projects with grading or excavation and thus most projects implement some form of stormwater pollution prevention controls during construction.

As described in Section 3.9, *Hydrology and Water Quality*, the Proposed Project would comply with the Construction General NPDES permit and prepare and implement a SWPPP. In addition, because the Proposed Project has the potential to encounter contaminated groundwater during OCS pole foundation excavation and other project excavation, Mitigation Measure HYD-1 would be implemented to control dewatering discharges appropriately. With compliance with the Construction General NPDES permit and mitigation measure, the Proposed Project's contribution to any cumulative impacts on water quality during construction would be reduced to a less-than-considerable level.

Operation

Water Quality and Runoff

Operation of the cumulative projects could impact water quality from an increase in impervious surfaces, increased handling of petroleum or other hazardous materials, and other activities (such as maintenance) that might result in contaminated stormwater runoff. HSR San Jose to Merced and Blended Service improvements would increase the total imperviousness in the area from proposed station improvements, passing track additions, and a new maintenance yard. Other cumulative projects would also increase the impervious surfaces in the area where developed on areas that currently allow for infiltration, thus increasing stormwater runoff. An increase in stormwater runoff can cause erosion and increases turbidity in downstream depending on local stream condition and can also result in increased pollutant loading due to contact with petroleum and other materials. In addition to these changes, the cumulative increase in diesel locomotive rail traffic (all cumulative rail services other than HSR, Proposed Project, and light rail) would increase the potential for leakage of diesel that could degrade surface water quality.

As described in Section 3.9, *Hydrology and Water Quality*, the Proposed Project would have a beneficial water quality impact by substantially reducing the use of diesel fuel for the Caltrain system and the potential for spills as well as diesel exhaust deposition into water systems. While the Proposed Project would add limited amount of new impervious surface, these additions are in areas where additional impervious surface is not likely to result in additional sediment loading in streams. Routine housekeeping practices and maintenance would control the potential for polluted runoff from new facilities. As a result, the Proposed Project's contribution to any potential cumulative water quality effects.

Groundwater Recharge

Cumulative increase in impervious surface could hinder groundwater recharge across the Peninsula. However, as described in Section 3.9, *Hydrology and Water Quality*, groundwater along the Caltrain ROW is not a substantial source of water supply. Nevertheless, cumulative increases impervious surfaces might affect local groundwater supplies. As described in Section 3.9, *Hydrology and Water Quality*, the Proposed Project would have limited effects on groundwater recharge. Considering the limited effect, and given the limited importance of local groundwater supplies, the Proposed Project's contribution to any potential cumulative impacts on groundwater recharge would be less than considerable.

Change in Drainage Patterns

Cumulative projects could result in changes to drainage patterns that might affect erosion or downstream sedimentation, polluted runoff, or affect stormwater drainage systems. However, in most cases, local planning requirements include analysis of project impacts on drainage systems and require fair-share contributions toward facility improvements over time. In addition, countywide stormwater pollution prevention programs focus on addressing substantial sources of increased runoff and require such projects to provide for both retention of water on-site and treatment of stormwater runoff.

As described in Section 3.9, *Hydrology and Water Quality*, the Proposed Project would not alter drainage patterns of existing drainage channels or streams. The additional impervious surface areas at TPFs would not significantly increase the rate or volume of surface runoff, particularly given the location of the two TPSs (which are the largest Proposed Project TPFs) in areas that are not of concern for runoff affecting water quality due to erosion of downstream channels. Thus, the Proposed Project's contribution to any potential cumulative drainage pattern impacts would be less considerable.

Flooding, including Flooding Resultant from Predicted Sea Level Rise

As shown in Figure 3.9-4 in Section 3.9, *Hydrology and Water Quality*, areas of the Peninsula close to San Francisco Bay are subject to coastal flooding at present and some areas along certain creeks and rivers, particularly in San Jose, are subject to flooding under 100-year event conditions.

HSR San Jose to Merced and Blended Service improvements, where located in the Caltrain ROW or adjacent, would be subject to similar flooding impacts as the Proposed Project both now and in the future. The Diridon, Millbrae and Redwood City Stations are not in current 100-year flood zones, but limited portions of the passing tracks (depending on location) might be. Flooding impacts for the maintenance yard would depend on location. Other cumulative projects could also be affected by flooding particularly if close to San Francisco Bay or along riverine flooding zones. All projects take into account flooding impacts when going through project review and approvals and in most cases take action to protect their facilities from substantial flooding. Where projects encroach on the 100-year floodplain, most projects implement project-level mitigation where necessary to avoid substantial increases in upstream or downstream flooding.

As described in Section 3.9, *Hydrology and Water Quality*, the Proposed Project could have some effect on flooding due to proposed locations of some of the TPFs in current floodplains. Mitigation Measure HYD-4 would require minimization of new impervious space for any TPFs proposed in floodplain areas, relocation of facilities, and/or use of TPF site locations outside the 100-year

floodplain. With this mitigation, the Proposed Project would not contribute considerably to potential cumulative flooding impacts of cumulative projects.

As described in Section 3.9, *Hydrology and Water Quality*, sea level rise is a particular concern in areas near San Francisco Bay as sea level rise is expected to rise up to 2 feet by 2050 and up to 5.5 feet by 2100. Parts of the Caltrain corridor are subject to coastal flooding at present and, with expected sea level rise in the future, this risk of coastal flooding will increase. As shown in Figure 3.9-5 in Section 3.9, *Hydrology and Water Quality*, with future sea level rise, more areas of the Peninsula close to San Francisco Bay will be subject to coastal flooding than at present and flooding along tidal channels will increase. Relative to areas near the Caltrain ROW, flood areas will expand from San Francisco to Redwood City. South of Redwood City, coastal flooding will also increase but the area of flooding is further away from the Caltrain ROW. Cumulative projects located in areas of potential increased coastal flooding in the future shown in Figure 3.9-5 could be subject to inundation causing risk to people and structures.

For future coastal flooding resultant from increased sea level rise, additional portions of the Caltrain ROW could be affected by flooding. Mitigation Measure HYD-7 requires Caltrain to adopt and implement a sea level rise vulnerability assessment and adaptation plan and work with other local partners to identify and implement adaptation measures to protect people and structures. However, as noted in Section 3.9, *Hydrology and Water Quality*, at this time, the feasibility of implementing all measures necessary to avoid future inundation associated with 100-year floods influenced by sea level rise is not known given that assessment of such solutions will be an ongoing, long-term, and multi-agency process. Consequently, because the Proposed Project would place additional people and structures in areas that could be affected by coastal flooding influenced by sea level rise and definitive mitigation to protect all parts of the Caltrain ROW and facilities is infeasible, the Proposed Project's contribution to potential cumulative risks of flooding would be considerable.

4.1.4.11 Land Use and Recreation

Impact CUMUL-10-LUR: Cumulative effects related to land use and recreation

The geographic context for the analysis of land use and recreation cumulative impacts consists of the areas within and adjacent to the Caltrain ROW. Physical division of an established community, conflict with applicable land use policies or plan adopted for the purpose of avoiding or mitigation an environmental effect, increase in the demand for or degradation of recreational facilities requiring construction or expansion of recreational facilities that would have an adverse effect on the environment would result in a significant cumulative impact.

Cumulative construction impact analysis focused on temporary impacts on existing land uses and recreation. Operational impact analysis addressed potential division of communities, land use policy/plan consistency, and direct/indirect changes in recreational facilities.

Cumulative projects included within this geographic context are all projects listed in Table 4-3. For analysis of recreation demand, cumulative growth in the three counties was also considered.

Construction

Construction of HSR San Jose to Merced and Blended Service improvements could impact land use and recreational facilities because of temporary disruptions on or adjacent to existing other land uses. Where construction occurs at or near the Tamien, Diridon, Millbrae (and possibly at the

Redwood City) Station, this would only be a concern for station use itself and would not impede adjacent land uses. Construction of passing tracks, if inside the Caltrain ROW would not disrupt adjacent uses. For construction of San Jose to Merced segment construction or Blended Service passing track locations outside the ROW, this could result in disruption of existing land uses as well as possibly adjacent uses, depending on access and staging. Construction of the maintenance yard would depend on locations; at the previously considered location in Brisbane, it presently consists of previously industrial land that is not in present use. Staging and access could also disrupt existing land uses temporarily, although staging and access are usually conducted on areas with open land (such as vacant lots and parking lots) wherein temporary disruption of existing use can be minimized.

Construction of other cumulative projects could also temporarily impact existing land uses adjacent to the Caltrain ROW, although most projects will either occur on vacant land or will displace the existing land uses prior to construction of the new use by limiting use and demolishing existing structures. Most projects would not displace adjacent existing uses during construction, except in the case of needs for substantial off-site staging or access.

The Proposed Project would be constructed within the Caltrain ROW, with the exception of the two TPSs (except for TPS2, Option 3 which is in the ROW), limited areas where the OCS alignment would be outside the Caltrain ROW, and areas where the ESZ would extend outside the Caltrain ROW and require vegetation clearance. Construction within the Caltrain ROW would not displace other land uses outside the ROW. As discussed in Section 3.10, *Land Use and Recreation*, the TPS location options, with the exception of TPS2 Option 2 and TPS2 Option 3, are vacant parcels surrounded by industrial or commercial areas. TPS2 Option 2 would displace existing industrial use and parking currently on the site; however, there are numerous alternative locations for industrial use in the vicinity. TPS3 Option 3 would be in a parking lot/open area at the CEMOF that is used for parking and as a laydown area. The construction of the OCS poles would primarily occur within the Caltrain ROW; however, in some locations the OCS poles would be erected on adjacent commercial, industrial and residential land. Some tree removal or pruning may be necessary on areas outside the Caltrain ROW, which could disrupt existing land uses. Temporary staging and access could also result in use of vacant lots inside and outside of the Caltrain ROW, but would not result in new land uses that might be inconsistent with adjacent land uses.

As discussed in Section 3.1, *Aesthetics*, construction activity in residential and park areas would be anomalous, and the visual character of such areas would be partially degraded during construction. The duration of OCS construction at any one location would be limited to the time necessary to install pole foundations and then later to install poles and string wires. The change in visual character would only occur for a limited period and the perception of the visual quality of such areas would not be altered once construction is complete. To ensure that the duration of construction disruption and activities are limited in areas of greater visual sensitivity, Mitigation Measure AES-2a would be implemented to avoid using residential or park areas for access or staging areas, to minimize the duration of construction activity in such areas (to the extent feasible) and to remove all construction equipment and materials immediately following completion of construction on such sites. Because the disruption of existing land uses during construction would be temporary, would not ultimately result in a conversion of land use (except at TPS2 Option 2, for which there are ample industrial sites for the displaced use and TPS3 Option 3 for which alternative sites can be identified for parking and laydown areas within the Caltrain ROW) and because Mitigation Measure AES-2a would ensure that disruption to individual residential areas or park areas is minimal, the

contribution of Proposed Project's construction to the cumulative significant impact on land use and recreation would be less than considerable.

Operation

Physically Divide a Community

Blended Service and other cumulative train service increases would occur along the existing Caltrain Corridor between San Jose and San Francisco. As such, operation of additional train service would not physically divide communities. The San Jose to Merced HSR segment would include new aerial and at-grade segments in San Jose along the Caltrain ROW from south of Tamien Station to the San Jose Diridon Station. This segment would not physically divide communities due to overhead aerial structures and the at-grade segments in the San Jose approach section are all along existing roads or rail rights of way and thus would not introduce new community divisions.

The Blended Service improvements at the Diridon, Millbrae and, potentially, Redwood City Stations would be an expansion of existing facilities given the existing railroad line at each location. A new maintenance yard would not likely physically divide a community given that feasible locations for such a yard are likely to be in commercial or industrial locations. If the new passing tracks are located in the Caltrain ROW at-grade, they would not change existing divisions of the community. Where passing tracks might encroach outside the Caltrain ROW, they would expand the width of the existing railroad ROW but would not prevent access from east to west at existing crossings. Where grade separations are proposed as part of Blended Service improvements, connections across the Caltrain ROW would be improved over existing conditions.

Most of the other cumulative projects are not likely to result in physical division of communities as they consist of residential, commercial and mixed use projects that are integrated into existing communities. However, large, elevated land development projects that are much higher than adjacent development can be perceived by some as dividing a community by creating a vertical separation, even though there may be no physical barriers between development at the ground level. Most transportation projects are proposed along existing transportation corridors, but if new large transportation facilities are proposed at-grade or elevated in new locations, they could physically divide communities and affect access between communities.

As described in Section 3.10, *Land Use and Recreation*, the Proposed Project would not physically divide existing communities. The OCS poles and wires would add additional infrastructure in the Caltrain ROW but would not physically impede access across the Caltrain ROW. There may be increased delays at some at-grade crossings, but the delays would be temporary and would not physically divide communities on either side of the Caltrain ROW. Thus, the contribution of the Proposed Project's operation to any potential cumulative impacts related to physically dividing a community would be less than considerable.

Land Use Plan and Policy Consistency

Conflicts of a project with land use policies do not, in and of themselves, constitute significant environmental impacts. Policy conflicts are considered environmental impacts only when they would result in direct environmental effects.

The Blended Service improvements at the Diridon, Millbrae and, potentially, Redwood City Stations would be consistent with long-term planning for transit uses at these locations. The consistency of a

new maintenance yard with existing land use plans and policies would depend on the proposed location. If the new passing tracks are located in the Caltrain ROW at-grade, they would be consistent with existing land use planning.

If HSR San Jose to Merced facilities or Blended Service passing tracks are placed outside the Caltrain ROW, they may or may not be consistent with local land use planning. If passing tracks are proposed outside the Caltrain ROW, they would likely be inconsistent with land use plans and policies of jurisdictions where land is designated for residential, commercial, open space or recreational uses. All of the five preliminarily identified passing track locations are adjacent to a mixture of residential, commercial, industrial, roadway, park and open space land uses. Because industrial use often includes railroad access tracks, the use of such areas for passing tracks may not result in significant environmental impacts different from those possible with allowed industrial uses.

Grade separations can often require large footprints and may require additional ROW acquisition and displacement of land uses as well as changing the land use character adjacent to existing land uses.

In addition to the inconsistency with local land use plans, passing tracks placed outside the Caltrain ROW may result in additional noise and aesthetic impacts during operation on land uses that are not presently adjacent to the Caltrain ROW. These impacts would represent additional inconsistencies with local land uses and policies. Further, passing track improvements that result in displacement of existing residential, commercial, or industrial land uses may increase pressure for residential, commercial, or industrial development at alternative locations, which may result in secondary physical environmental impacts. Given that the design and location of the passing tracks, the maintenance yard, and any other necessary improvements (which may include grade separations) are unknown at present, a definitive conclusion regarding the consistency of Blended Service improvement with land use plans and policies cannot be made. In the event that substantial Blended Service improvements are placed outside the ROW in non-industrial areas, the inconsistency with plans and policies could be a significant and unavoidable impact.

Other cumulative projects may or may not be consistent with local land use policies and plans. Many projects are proposed consistent with current local land use planning; some projects seek general plan and zoning amendments to allow uses that are not consistent with current local planning. All local land use projects must be approved by land use jurisdictions. Thus, if projects are inconsistent with local land use plans and policies and the city or county decides to approve them, the city or county is required by law to amend local land use plans and policies or make the appropriate findings prior to approving inconsistent uses. Most other cumulative transportation projects are proposed along existing transportation corridors. However, as with potential Blended Service passing tracks outside the Caltrain ROW, large transportation facilities in new locations outside transportation corridors could result in significant conflicts with local land use plans and policies.

As described in Section 3.10, *Land Use and Recreation*, the Proposed Project would generally be consistent with the local plans and policies, including land use designations and zoning, except at some of the TPF sites. The majority of the Proposed Project, including OCS poles and wires, the paralleling stations, and the switching station would be located within the existing Caltrain ROW and would, therefore, not impact adjacent land use plans. The Proposed Project would result in several inconsistencies with local plans and policies, specifically, at the location of TPS1 Option 2, and at locations where the OCS alignment and ESZ would be outside rail or road ROW. However, the Proposed Project would not displace existing or potential future development (except the existing

industrial/warehouse use, which can be readily absorbed at other San Jose industrial sites, at the TPS2 Option 2 site) and, thus, would not result in significant secondary environmental impacts as a result of the inconsistencies with local land use plans and policies.

At TPS1, Option 3 there is a pending hotel application under evaluation by the City of South San Francisco for which an EIR will be released in 2015. If approved and constructed, then construction of TPS1 at this location may be in conflict with the hotel, depending on the remaining developable land at the site. As described in Section 3.11, there are noise impacts of locating a TPS at this site adjacent to an existing hotel but mitigation would lower the potential noise impact to less than significant. Similarly, if the new hotel is built and there were still remaining land at the site for a TPS, then the noise mitigation would still apply. If the hotel is built, the costs of land acquisition would increase, and may be a consideration for Caltrain in deciding on which potential site to locate the TPS. An additional option, Option 4 was added by Caltrain at the request of the City of South San Francisco in order to increase the options for Caltrain as Option 3 may be more conflicted in the future than in 2013 at the start of the CEQA process.

PS4, Options 1 and 2 would be located within an area envisioned for Transit Oriented Development and a Transit Center and associated improvements as part of the Hillsdale Station Area Plan. As concluded in Section 3.10, these two options would require minor reconfiguration of the plan, but would not hinder the ability to develop TOD overall, provide a Transit Center, or relocate the Caltrain Hillsdale Station and thus development would not be displaced from the site. PS4, Option 3 would not require the minor reconfiguration. Also, see discussion under cumulative aesthetics.

SWS Option 1 would be located adjacent to, but not in an area proposed for mixed residential/commercial/light industrial use in the Redwood Triangle portion of the North Fair Oaks Community Plan. Because SWS, Option 1 is outside of the plan area, it would not displace any potential other land uses in the plan area. The mixed-use development can be fully realized within the plan area. Also, see discussion under cumulative aesthetics.

Thus, contribution of the Proposed Project operation to any potential cumulative impacts related to land use policy or plan conflicts (and resultant secondary physical impacts on the environment) would be less than considerable.

Damage to or Demand for Recreational Facilities

The San Jose to Merced HSR segment (where along the Caltrain ROW in San Jose) would avoid Fuller Park but may affect Kurte Park as this park is directly adjacent to the Caltrain Row.

The Blended Service improvements at the Diridon, Millbrae and, potentially, Redwood City Stations would have no impacts on parks or recreation facilities. The new maintenance yard's impact on parks or recreation facilities would depend on location, although it is highly unlikely that the facility would be proposed at or adjacent to an existing park or open space location (the previously studied Brisbane/Bayshore site is a former landfill site not used for recreation).

Where Blended Service passing tracks are located within the Caltrain ROW, they would not result on encroachment onto park lands. However, if passing tracks are proposed outside the Caltrain ROW, they could affect park or open space directly adjacent the Caltrain ROW. Based on Table 3.10-2 in Section 3.10, *Land Use and Recreation*, all of the five preliminarily identified passing track locations would be adjacent to parks.

- The North 4 Track (San Francisco to Burlingame): Lions Park and Lomita Park (both in San Bruno).
- The Long-Middle 4 Track (San Mateo to Redwood City): Trinta Park (San Mateo); John S. Roselli Memorial Park (Redwood City): Main Street Park (Redwood City); and Broadway-Arguello Park (Redwood City).
- The Short-Middle 4 Track (San Mateo to San Carlos): Trinta Park (San Mateo).
- The Middle 3 Track (San Mateo to Palo Alto): Trinta Park (San Mateo); John S. Roselli Memorial Park (Redwood City): Main Street Park (Redwood City); Broadway-Arguello Park (Redwood City); Holbrook-Palmer Park (Atherton); El Camino Park (Palo Alto); El Palo Alto Park (Palo Alto); Embarcadero Bike Path (Palo Alto); and Peers Park (Palo Alto).
- The South 4-Track (Mountain View to Santa Clara): Rengstorff Park and Resident Park (Mountain View).

Whether any of these parks would actually be affected would depend on the width of the Caltrain ROW, the feasibility to stay within the ROW, and the alignment of any passing tracks outside the ROW. The design of passing tracks is unknown and, thus, no definitive conclusion can be made about whether any parks would actually be affected or not. However, pursuant to the mandatory requirements of Section 4(f) of the Department of Transportation (DOT) Act of 1966, CHSRA will first consider options for avoiding park impacts in design of any passing tracks. If park impacts cannot be avoided, then Section 4(f) requires mitigation to provide additional park space so that no overall loss of park space and recreational opportunities results.

Most other cumulative transportation projects are proposed along existing transportation corridors, but if new large transportation facilities are proposed outside transportation corridors, this could affect existing park or recreation areas. Large transportation projects are also subject to the requirements of Section 4(f) if they are federally funded or authorized (which is most large transportation projects). Other non-transportation projects are less likely to physically encroach on existing park or recreational areas. Cumulative projects that propose new housing units would increase population and would increase the demand for recreational facilities. While there are many park areas throughout the San Francisco Peninsula, it is possible that continued growth will start to result in overuse of existing park and recreational facilities and create pressure for new park and recreational facilities.

As described in Section 3.10, *Land Use and Recreation*, the Proposed Project may require tree removal at Broadway-Arguello Park (Redwood City), Holbrook-Palmer Park (Atherton) and at Peers Park (Palo Alto). Mitigation Measure BIO-5 requires replacement of removed trees and, as discussed in Section 3.10, *Land Use and Recreation*, it is feasible to replace trees removed at parks at the parks themselves to maintain their visual screening function from the Caltrain ROW without loss of substantial portions of the parks. Given that Blended Service improvements or other cumulative transportation projects would be required to avoid and/or mitigate for park impacts per the Section 4(f) requirements, other cumulative projects are unlikely to affect parks, and the Proposed Project's park impacts would be mitigated, cumulative impacts are likely to be mitigable to a less than significant level. Given the project-level mitigation described above, the Proposed Project's contribution to any potential cumulative impacts would be less than considerable with mitigation.

4.1.4.12 Noise and Vibration

Impact CUMUL-11-NOI: Cumulative increase in noise or vibration

The geographic context for the analysis of potential cumulative construction- and operation-related noise and vibration impacts consists of the Caltrain ROW, the adjacent areas, and areas adjacent to access and haul routes (i.e., nearby locations with sensitive noise receptors) used by cumulative projects and the Proposed Project. Present and probable future cumulative projects with the potential for cumulative impacts related to noise and vibration are listed in Table 4-3.

Construction

During construction, an increase in noise and vibration levels, could impact the sensitive receptors in the project vicinity. Cumulative noise and vibration impacts would primarily result from simultaneous construction of different projects in the same location at the same time; however where construction occurs in quick succession in the same area, there could also be a cumulative impact due to the extended duration of construction disruption.

Construction of the Proposed Project would occur years before prior to the construction of the HSR San Jose to Merced and Blended Service improvements and thus there would no simultaneous construction noise or vibration effects.

Construction of the Transbay ~~Terminal~~ Transit Center is currently under way, but the TTC is located more than one mile from the San Francisco 4th and King Station, so there would be no cumulative noise effects resulting from simultaneous construction of the TTC and the Proposed Project. Construction of the DTX would occur after completion of the Proposed Project, so there would be no simultaneous construction noise impacts at their overlap at the 4th and King Station and yard.

Construction of the Proposed Project would overlap in time and location with the projects specified as having such overlap in Table 4-3, including the following substantial transportation projects:

- Caltrain South Terminal Improvements (Santa Clara – San Jose).
- BART Silicon Valley Extension, if construction starts by 2020 ~~2019~~ (Santa Clara – San Jose).
- Other Caltrain Improvements (various locations).
- BART Millbrae Tail Tracks (south of Millbrae Station).
- Central Subway (near San Francisco 4th and King Station).
- Muni 22-Fillmore Electric Trolley Bus Re-Routing (16th Street in San Francisco).
- Other grade separations (Rengstorff, possibly others in San Mateo County).
- Muni T-Line ~~Extension~~ southern extension to the Caltrain Bayshore station, if construction starts by 2019 ~~(Caltrain Bayshore Station)~~.
- Palo Alto Caltrain Station/Bus Transit Center Expansion, if construction starts by 2020 ~~2019~~ (Caltrain Palo Alto Station).
- Tasman Express Long T Double-tracking (Mountain View Station).

In addition, as noted in Table 4-3, there are numerous land use development projects that have planned or potential construction periods that could overlap with Proposed Project construction.

With multiple cumulative construction projects in close adjacency, there is the potential for significant cumulative construction noise and vibration impacts.

As discussed in Section 3.11, *Noise and Vibration*, the Proposed Project construction would have potentially significant noise and vibration impacts during construction. Mitigation Measure NOI-1a would require development and implementation of a noise control plan to reduce potential construction noise impacts but would not necessarily reduce all noise impacts at all times during construction to a less than significant level, particularly with the likelihood of substantial night-time construction expected with the Proposed Project. Because there will be other cumulative projects in construction adjacent to the Caltrain ROW at the same time, the Proposed Project could result in a cumulatively considerable contribution to cumulative construction noise impacts. Even with mitigation, these cumulative impacts could be significant and unavoidable

Proposed Project construction vibration impacts would be reduced to a less than significant level with Mitigation Measure NOI-2a. Given this mitigation and the fact that vibration levels due not accumulate (like noise levels can), the Proposed Project would not contribute considerably to cumulative construction vibration impacts.

Operational

Operational Noise

Cumulative Rail Projects

As shown in Table 4-8 above, if Blended Service and other cumulative freight and passenger rail service increases all come to fruition as hoped by project proponents, there would be a substantial increase in the number of daily trains using the Caltrain corridor itself by both 2020 and 2040. For example in the segment between Santa Clara and San Jose, which is the most heavily used segment by passenger services other than Caltrain and by freight service today, by 2040 there could be an increase from approximately 116 passenger trains and nine freight trains today to perhaps as many as 176 passenger trains and 19 freight trains daily in 2040. Between Santa Clara and Redwood City, there could be an increase from approximately 94 passenger trains and two freight trains today to perhaps as many as 204 to 230[15] passenger trains and four freight trains daily in 2040. Between Redwood City and San Francisco, there could be an increase from approximately 92 passenger trains and six freight trains today to perhaps as many as 204 to 230 passenger trains and 12 freight trains daily in 2040. Increased passenger and freight rail service would increase noise levels along the Caltrain ROW as well as at any maintenance facilities for Caltrain, HSR, freight, or other tenant rail services.

In addition to an increase in train service, Blended Service operations (for both HST and Caltrain) up to 110 mph, up from the present maximum of 79 mph would also increase potential cumulative noise levels.

The HSR San Jose to Merced from San Jose Diridon to south of the Tamien Station would be along the Caltrain ROW on aerial structures to south of the Tamien Station, then at-grade to south of Pullman Way, then on aerial south to just north of Capitol Expressway. While HSR service south of the

[15] The range indicated includes 40 to 53 daily round-trip (80 to 106 one-way) HSR trains from Table 4-8, but the noise analysis was completed for 53 daily round trip HSR trains as this is consistent with CHSRA 2014 Business Plan.

Diridon Station was not included in the cumulative noise modeling (because it would not be on the same tracks as Caltrain), HSR operations in this segment where parallel to the Caltrain ROW would add additional noise in this part of San Jose.

Modeling of Cumulative Rail Noise Levels

The potential cumulative rail noise using the Caltrain corridor due to the increases levels of service shown in Table 4-8[16] were modeled by WIA for the following cumulative scenarios:

- 2020 Cumulative without project scenario: In this scenario, Caltrain service would include 92 trains between San Jose and San Francisco using diesel locomotives and the cumulative increases of other rail services would be as shown in Table 4-8.
- 2020 Cumulative with project scenario: In this scenario, Caltrain service would include 114 trains between San Jose and San Francisco of which 75 percent would be EMUs and 25 percent would be diesel service and the cumulative increases of other rail services would be as shown in Table 4-8.
- 2040 Cumulative without project scenario: In this scenario, Caltrain service would include 92 trains between San Jose and San Francisco using diesel locomotives and the cumulative increases of other rail services would be as shown in Table 4-8 without High Speed Rail.
- 2040 Cumulative with Full Caltrain Electrification scenario: In this scenario, Caltrain service would include 114 trains between San Jose and San Francisco using EMUs and the cumulative increases of other rail services would be as shown in Table 4-8 without High Speed Rail.
- 2040 Cumulative with Blended Service, 79 mph Scenario: In this scenario, Caltrain service would include 114 trains between San Jose and San Francisco using EMUs and the cumulative increases of other rail services would be as shown in Table 4-8 including High Speed Rail Blended Service operating up to 79 mph.
- 2040 Cumulative with Blended Service, 110 mph Scenario: In this scenario, Caltrain service would include 114 trains between San Jose and San Francisco using EMUs and the cumulative increases of other rail services would be as shown in Table 4-8 including High Speed Rail Blended Service operating up to 110 mph.

This noise modelling was done on a worst-case basis assuming that all of the service levels identified in Table 4-8 occur[17] and not assuming any improvements in trackage (such as new track, ties, or trackbed treatments that may lower noise) or any new grade separations (except for those included in the under construction San Bruno Grade Separation Project). As described above, for the Cumulative Blended Service scenarios, there will be Core Capacity projects constructed to accommodate the mixing of Caltrain and HSR service and thus noise levels for the Blended Service scenarios will likely be less than those indicated in Table 4-11.

[16] As noted above, the *2014 Business Plan: 2014 Service Planning Methodology* (CHSRA 2014c) describes 53 daily round-trip trips (106 trains) to San Francisco which is the assumption used in the cumulative noise analysis. ~~However, this Draft EIR analyzes 40 daily roundtrips (80 trains), based on the adopted *2012 Revised Business Plan* because this level of service is consistent with Caltrain analysis of Blended Service to date. If more round-trips occur, then noise levels may be higher than those identified in this section.~~

[17] As noted above, for HSR it was assumed that service levels would be 53 daily round trips per the 2014 CHSRA Business Plan.

Table 4-11. Cumulative Rail Noise Impacts, Overview

Year	Scenario	Impacts per FTA Noise Criteria: No Impact	Moderate Impact	Severe Impact
2020	Cumulative[a] without Project	34	15	0
	Cumulative[a] with Project	37 ~~36~~	12 ~~13~~	0
2040	Cumulative[b] without Project	1	39	9
	Cumulative[b] with Full Caltrain Electrification[c]	5 ~~4~~	38 ~~37~~	6 ~~8~~
	Cumulative[b] with Blended Service (79 mph scenario)	1 ~~1~~	17 ~~4~~	31 ~~44~~
	Cumulative[b] with Blended Service (110 mph scenario)	1	4	44

Source: Appendix C, *Noise and Vibration Technical Report*

[a] Cumulative 2020 scenarios include freight and other passenger rail service levels noted in Table 4-8 but do not include high speed rail.

[b] Cumulative 2040 scenarios include freight and other passenger rail service levels noted in Table 4-8 and vary based on whether the Proposed Project, Caltrain Full Electrification, or Blended Service is included. San Jose to Merced HSR operations are not included in this analysis but could add additional noise at two locations in San Jose, although the HSR alignment is not parallel to the Caltrain ROW at these study locations.

[c] Caltrain Full Electrification is not part of the Proposed Project but is considered the likely situation for 2040.

The cumulative noise change was characterized in comparison with existing noise levels along the Caltrain corridor at 49 study locations (see discussion in Section 3.11, *Noise and Vibration*). The change from existing noise levels with each cumulative scenario was then compared with the FTA moderate and severe impact thresholds.

With cumulative train service increases, under the worst-case assumptions noted above, there could be significant cumulative noise impacts in all 2020 and 2040 scenarios evaluated, compared with existing conditions. As discussed in Appendix C, *Noise and Vibration Technical Report*, the most substantial contributor to increases in cumulative noise over existing levels is freight service at most locations. Although the number of additional freight trains is smaller than the cumulative passenger trains included in the various cumulative scenarios, freight trains are heavier and longer than passenger trains and thus for similar speeds, they generally result in greater noise levels.

The summary of results by scenario is presented in Table 4-11 and comparative results by study location are shown in Table 4-12 (2020) and Table 4-13 (2040).

Figure 4-3 shows the average noise levels across the entire Caltrain corridor with different cumulative scenarios and the contribution of different cumulative rail services.

Figure 4-4 shows the noise levels at the 49 different study locations comparing existing noise levels, cumulative conditions without the project and cumulative conditions with Caltrain Full Electrification in 2040. As shown in Table 4-13, in 2040 Caltrain Full Electrification would reduce cumulative noise levels at 45 ~~42~~ locations, ~~while increasing noise levels at one location~~, with no change at four ~~six~~ locations compared with Cumulative No Project Conditions.

Table 4-12. 2020 Cumulative Rail Noise Levels, Change over Existing (dBA)

Setting			Change from Existing - 2020		
Site No	Location	City	Cumulative w/o Project[a]	Cumulative w/ Project[a]	*Project Contribution*
1	Oakdale Ave and Quint Ave	San Francisco	0.9	0.7	-0.2
2	Reddy St and Williams Ave	San Francisco	0.8	0.5	-0.3
3	Carr St and Paul Ave	San Francisco	0.8	0.6	-0.2
4	Tunnel Ave and Lathrop Ave	San Francisco	0.6	0.6	0.0
5	Herman St and Tanforan Ave	San Bruno	0.8	0.4	-0.4
6	Huntington Ave and San Bruno Ave	San Bruno	-1.1	-1.3	-0.2
7	Montgomery Ave and Walnut St	San Bruno	-0.4	-0.6	-0.2
8	1st Ave and Pine St	San Bruno	-1.1	-1.4	-0.3
9	Huntington Ave and Sylvan Ave	San Bruno	-1.2	-1.5	-0.3
10	San Antonio Ave and San Benito Ave	San Bruno	0.9	0.7	-0.2
11	Monterey St and Santa Paula Ave	Millbrae	0.8	0.8	0.0
12	Hemlock Ave and Hemlock Dr	San Mateo County	0.8	0.8	0.0
13	California Dr and Dufferin Ave	Burlingame	0.9	0.7	-0.2
14	California Dr and Mills Ave	Burlingame	0.7	0.7	0.0
15	California Dr and Palm Dr	Burlingame	0.9	0.9	0.0
16	Park Ave and Carolan Ave	Burlingame	0.8	0.8	0.0
17	Grand Blvd and San Mateo Blvd	San Mateo	0.7	0.7	0.0
18	Railroad Ave and Monte Diablo	San Mateo	0.6	0.6	0.0
19	B St and 9th Ave	San Mateo	0.8	0.8	0.0
20	South Blvd and 16th Ave	San Mateo	0.6	0.2	-0.4
21	Pacific Blvd and Otay Ave	San Mateo	0.8	0.7	-0.1
22	Country Rd and Dale View Ave	San Mateo	0.8	0.5	-0.3
23	Country Rd and Marine View	Belmont	0.8	0.7	-0.1
24	Country Rd and Springfield Ave	San Carlos	0.6	0.6	0.0
25	D St and Stafford St	Redwood City	0.7	0.8	0.1
26	Cedar St and Main St	Redwood City	0.6	0.7	0.1
27	198 Buckingham Ave	Redwood City	0.9	0.6	-0.3
28	Arrowhead Lane and 5th Ave	San Mateo County	1.0	0.6	-0.4
29	Lloyden Dr and Fair Oaks Lane	Atherton	0.8	0.5	-0.3
30	Felton Dr and Encinal Ave	Atherton	0.9	0.6	-0.3
31	Burgess Dr and Alma St	Menlo Park	1.0	0.8	-0.2

Setting			Change from Existing - 2020		
Site No	Location	City	Cumulative w/o Project[a]	Cumulative w/ Project[a]	*Project Contribution*
32	Mitchell Lane and University Ave	Palo Alto	0.9	0.7	-0.2
33	Alma St and Lincoln Ave	Palo Alto	0.8	0.5	-0.3
34	Residences near Peers Park	Palo Alto	0.8	0.4	-0.4
35	Alma St and El Dorado Ave	Palo Alto	1.0	0.6	-0.4
36	4237 Park Blvd	Palo Alto	1.1	1.2	0.1
37	Central Exp and Thompson Ave	Mountain View	1.1	0.8	-0.3
38	Evelyn Ave and Bryant St	Mountain View	0.9	0.7	-0.2
39	Central Exp and Whisman Ave	Mountain View	0.9	0.9	0.0
40	S. Bernardo Ave and Evelyn Ave	Mountain View	0.8	0.3	-0.5
41	Asilomar Ave and Mary Ave	Sunnyvale	1.0	0.8	-0.2
42	332 Angel Ave	Sunnyvale	0.8	0.7	-0.1
43	Fair Oaks Ave and Evelyn Ave	Sunnyvale	1.0	0.8	-0.2
44	Agate St and Lawrence Exp	Santa Clara	0.7	0.7	0.0
45	Agate Dr and Bowers Ave	Santa Clara	0.8	0.6	-0.2
46	Alvarado Dr and San Thomas Exp	Santa Clara	0.7	0.4	-0.3
47	2109 Main St	Santa Clara	0.7	0.4	-0.3
48	782 Auzerais Ave	San Jose	-0.4	-0.4	0.0
49	456 Jerome St	San Jose	-0.4	-1.4	-1.0
Increases			*43*	*43*	*3* ~~*8*~~
Decreases			*6*	*6*	*33* ~~*33*~~
No change			*0*	*0*	*13* *8*

Source: Appendix C, *Noise and Vibration Technical Report*

[a] Cumulative 2020 scenarios include freight and other passenger rail service levels noted in Table 4-8 but do not include high speed rail.

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1 **Table 4-13. 2040 Cumulative Rail Noise Levels, Change over Existing (dBA)[a]**

			Change from Existing - 2040				
Site No.	Location	City	2040 Cumulative No Project	2040 Cumulative with Caltrain Full Electrification	*Change with Caltrain Full Electrification*	2040 Cumulative with Blended Service (79 mph)	2040 Cumulative with Blended Service (110 mph)
1	Oakdale Ave and Quint Ave	San Francisco	2.7	2.5	-0.2	3.0	3.6
2	Reddy St and Williams Ave	San Francisco	2.5	2.2	-0.3	2.9	3.7
3	Carr St and Paul Ave	San Francisco	2.7	2.4	-0.3	2.9	3.6
4	Tunnel Ave and Lathrop Ave	San Francisco	2.0	1.7	-0.3	3.0	3.1
5	Herman St and Tanforan Ave	San Bruno	2.4	2.0	-0.4	2.6	2.6
6	Huntington Ave and San Bruno Ave	San Bruno	0.7	0.4	-0.3	0.9	1.5
7	Montgomery Ave and Walnut St	San Bruno	1.4	1.2	-0.2	1.5	2.0
8	1st Ave and Pine St	San Bruno	0.6	0.4	-0.2	0.8	1.5
9	Huntington Ave and Sylvan Ave	San Bruno	0.5	0.2	-0.3	0.8	1.5
10	San Antonio Ave and San Benito Ave	San Bruno	2.9	2.7	-0.2	3.1	3.5
11	Monterey St and Santa Paula Ave	Millbrae	2.6	2.5	-0.1	2.7	2.8
12	Hemlock Ave and Hemlock Dr	San Mateo County	2.3	2.2	-0.1	3.0	3.2
13	California Dr and Dufferin Ave	Burlingame	2.9	2.7	-0.2	3.1	3.5
14	California Dr and Mills Ave	Burlingame	2.4	2.3	-0.1	3.3	3.2
15	California Dr and Palm Dr	Burlingame	2.7	2.7	0.0	3.2	3.2
16	Park Ave and Carolan Ave	Burlingame	2.6	2.6	0.0	3.2	3.2
17	Grand Blvd and San Mateo Blvd	San Mateo	2.0	1.8	-0.2	3.0	3.2
18	Railroad Ave and Monte Diablo	San Mateo	1.8	1.5	-0.3	3.0	3.2
19	B St and 9th Ave	San Mateo	2.5	2.5	0.0	3.3	3.2
20	South Blvd and 16th Ave	San Mateo	2.0	1.4	-0.6	2.7	3.9
21	Pacific Blvd and Otay Ave	San Mateo	2.4	2.2	-0.2	3.0	3.4

			Change from Existing - 2040				
Site No.	Location	City	2040 Cumulative No Project	2040 Cumulative with Caltrain Full Electrification	*Change with Caltrain Full Electrification*	2040 Cumulative with Blended Service (79 mph)	2040 Cumulative with Blended Service (110 mph)
22	Country Rd and Dale View Ave	San Mateo	2.6	2.3	-0.3	3.0	3.7
23	Country Rd and Marine View	Belmont	2.6	2.4	-0.2	3.1	3.3
24	Country Rd and Springfield Ave	San Carlos	2.0	1.7	-0.3	3.0	3.2
25	D St and Stafford St	Redwood City	2.0	1.9	-0.1	3.1	3.0
26	Cedar St and Main St	Redwood City	1.9	1.8	-0.1	3.1	3.1
27	198 Buckingham Ave	Redwood City	2.1	1.7	-0.4	2.6	3.7
28	Arrowhead Lane and 5th Ave	San Mateo County	2.2	1.7	-0.5	2.6	3.7
29	Lloyden Dr and Fair Oaks Lane	Atherton	1.4	0.9	-0.5	2.6	3.5
30	Felton Dr and Encinal Ave	Atherton	1.6	1.1	-0.5	2.6	3.4
31	Burgess Dr and Alma St	Menlo Park	2.9	2.7	-0.2	3.1	3.5
32	Mitchell Lane and University Ave	Palo Alto	1.9	1.5	-0.4	2.7	3.5
33	Alma St and Lincoln Ave	Palo Alto	2.3	1.9	-0.4	2.8	3.7
34	Residences near Peers Park	Palo Alto	1.7	0.9	-0.8	2.4	3.9
35	Alma St and El Dorado Ave	Palo Alto	2.6	2.3	-0.3	2.8	2.8
36	4237 Park Blvd	Palo Alto	2.2	2.2	0.0	3.1	3.0
37	Central Exp and Thompson Ave	Mountain View	2.7	2.5	-0.2	2.9	2.8
38	Evelyn Ave and Bryant St	Mountain View	2.1	1.8	-0.3	2.7	2.6
39	Central Exp and Whisman Ave	Mountain View	3.3	3.2	-0.1	3.3	3.5
40	S. Bernardo Ave and Evelyn Ave	Mountain View	1.7	1.0	-0.7	2.4	3.8
41	Asilomar Ave and Mary Ave	Sunnyvale	2.0	1.7	-0.3	2.8	3.4
42	332 Angel Ave	Sunnyvale	2.1	1.9	-0.2	3.0	3.3
43	Fair Oaks Ave and Evelyn Ave	Sunnyvale	2.7	2.5	-0.2	3.0	3.6

			Change from Existing - 2040				
Site No.	Location	City	2040 Cumulative No Project	2040 Cumulative with Caltrain Full Electrification	*Change with Caltrain Full Electrification*	2040 Cumulative with Blended Service (79 mph)	2040 Cumulative with Blended Service (110 mph)
44	Agate St and Lawrence Exp	Santa Clara	2.2	2.0	-0.2	3.2	3.9
45	Agate Dr and Bowers Ave	Santa Clara	2.7	2.4	-0.3	3.0	3.6
46	Alvarado Dr and San Thomas Exp	Santa Clara	2.4	2.0	-0.4	2.8	3.8
47	2109 Main St	Santa Clara	2.4	2.0	-0.4	2.8	3.8
48	782 Auzerais Ave	San Jose	1.3	1.2	-0.1	1.2	1.2
49	456 Jerome St	San Jose	1.2	0.6	-0.6	0.6	0.6
Increases			*49*	*49*	*0 ~~1~~*	*49*	*49*
Decreases			*0*	*0*	*45 ~~42~~*	*0*	*0*
No Change			*0*	*0*	*4 ~~6~~*	*0*	*0*

Source: Appendix C, *Noise and Vibration Technical Report*

[a] Cumulative 2040 scenarios include freight and other passenger rail service levels noted in Table 4-8 and vary based on whether the Proposed Project, Caltrain Full Electrification, or Blended Service is included. San Jose to Merced HSR operations are not included in this analysis but could add additional noise at study locations 48 and 49, although the HSR alignment is not parallel to the Caltrain ROW at these study locations.

[b] Caltrain Full Electrification is not part of the Proposed Project but is considered the likely situation for 2040.

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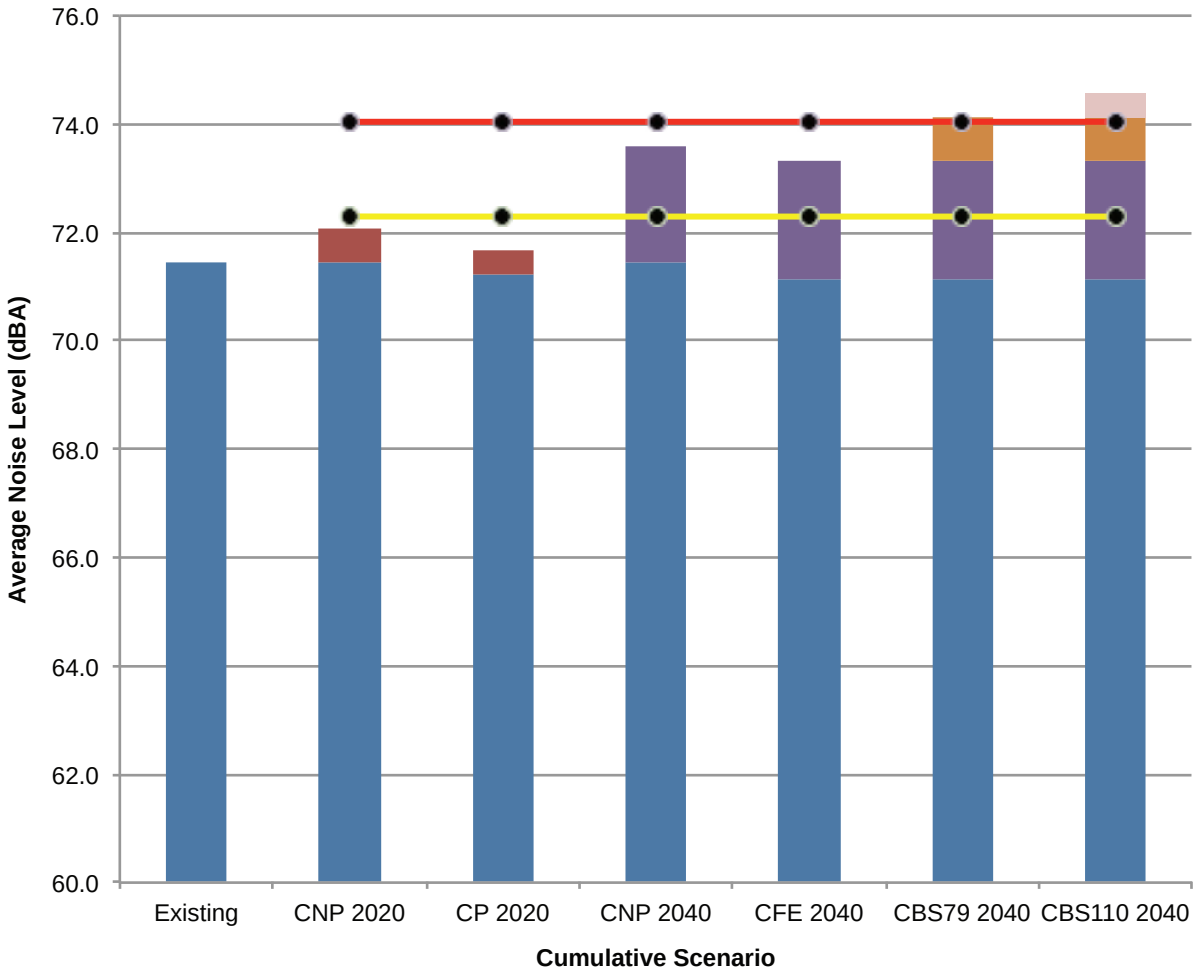

2040 Blended Service (up to 110 mph)

2040 Blended Service (up to 79 mph)

2040 No Project

2020 No Project

Existing

Average FTA Moderate Impact

Average FTA Severe Impact

The effects of the Project in 2020 and Full Electrification in 2040 are not specifically shown because, on average the effect of replacing existing diesel locomotives with EMUs would be to reduce noise levels. In order to include this reducing effect in this graphic, in the 2020 cumulative with project scenario, the existing noise levels shown have been lowered by the average noise reduction of 0.2 dBA for 2020 with the Project compared to No Project conditions. In the 2040 cumulative with project scenarios (including the Blended Service scenarios), the existing noise levels shown have been lowered by the average noise reduction of 0.3 dBA for 2040 with the project compared to No Project conditions.

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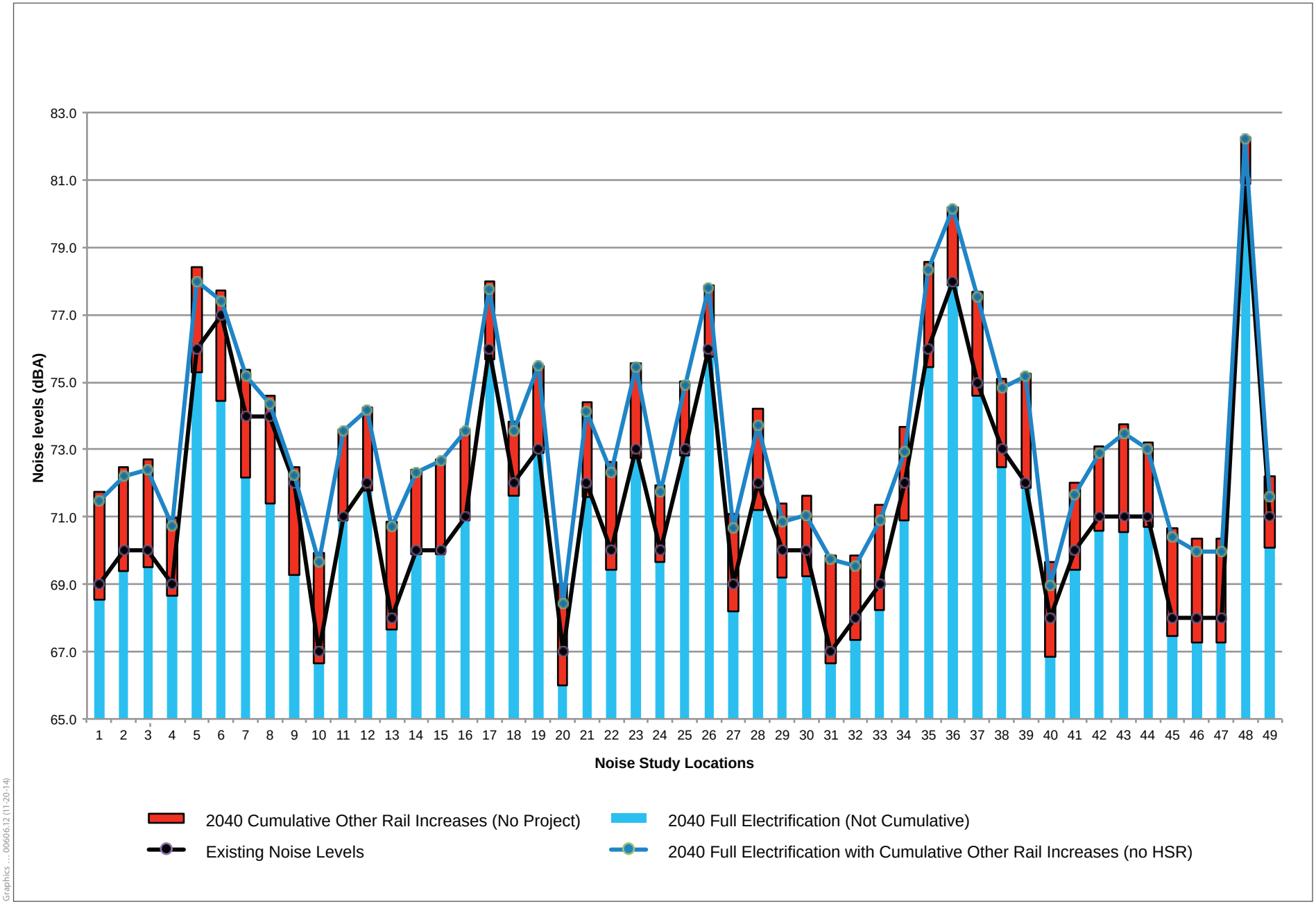
Note: This figure replaces Figure 4-3 from the Draft EIR.

Figure 4-3

Average Noise Levels along Caltrain Corridor by Cumulative Scenario (dBA)

Peninsula Corridor Electrification Project



Graphics ... 00606.12 (11-20-14)

Note: This figure replaces Figure 4-4 from the Draft EIR.

Figure 4-4
2040 Cumulative Noise Levels along Caltrain Corridor
Peninsula Corridor Electrification Project

Figure 4-5 shows the noise levels at the 49 study locations comparing existing noise levels with different cumulative scenarios. As shown, in 2040, for the Cumulative with Blended Service scenarios (both 79 mph and 110 mph), the largest share of increases (approximately 68 ~~to 75 percent~~) over the FTA severe criteria are due to freight/other rail increases with the remainder (approximately ~~25 to~~ 32 percent) due to Blended Service.

Noise modeling results are presented in greater detail in Appendix C, *Noise and Vibration Technical Report*.

All Other Projects

During operation, the non-rail cumulative projects could also increase noise levels and affect sensitive receptors in the vicinity of the Caltrain ROW. Operation of the land use developments and other regional transportation projects would increase noise levels by introducing more people, activities and traffic into the project vicinity. In addition, land development projects along the Caltrain ROW would also introduce more sensitive receptors that would be subject to the cumulative noise levels from increased passenger and rail service described above.

Proposed Project Cumulative Contribution

As described in Section 3.11, *Noise and Vibration*, the Proposed Project would result in both beneficial and adverse noise effects compared with existing conditions. The Proposed Project would replace diesel locomotives with EMUs, which are quieter. However, the Proposed Project would also increase service, which would increase train horn noise. In 2020, the Proposed Project would lower existing noise levels at 37 ~~38~~ locations, increase noise levels at 4 ~~8~~ locations and have no change at 8 study locations. All project level noise increases would be less than the FTA impact thresholds.

Also as described in Section 3.11, *Noise and Vibration*, the Proposed Project would result in significant noise impacts due to noise from TPFs at one location. Mitigation Measure NOI-1b is proposed to require enclosures and site design to control noise at the one TPF location where needed to avoid significant impacts to nearby sensitive receptors. Relative to TPF noise alone, this mitigation would reduce any potential TPF noise contributions to potential cumulative impacts.

Where the Proposed Project would result in lower noise levels or the same noise levels compared with No Project conditions, it would not contribute to cumulative rail noise impacts. As shown in Table 4-12, in 2020, the Proposed Project would contribute to increased noise levels at four ~~six different~~ study locations compared with 2020 Cumulative No Project conditions although, as shown in Figure 4-3, the Proposed Project would lower noise levels on average. As shown in Table 4-12, only three of the four locations would have cumulatively significant noise increases in 2020, but all four locations would have cumulatively significant noise increases in 2040 as shown in Table 4-13. As shown in Table 4-13, under 2040 conditions, the combined effect of the Proposed Project and Caltrain Full Electrification would result in increased noise levels at ~~only one~~ no study locations compared with 2040 No Project conditions. As shown in Figure 4-3, on average, the Proposed Project and Caltrain Full Electrification would lower noise levels along the Caltrain corridor. However, Caltrain Full Electrification is not part of the Proposed Project and thus under 2040 conditions, the Proposed Project is assumed to contribute to increased noise levels at the same four ~~six~~ study locations identified for 2020 cumulative conditions.

Thus, at the four ~~six~~ locations identified in Table 4-12 where the Proposed Project would result in noise increases, the Proposed Project would make a considerable contribution to the significant

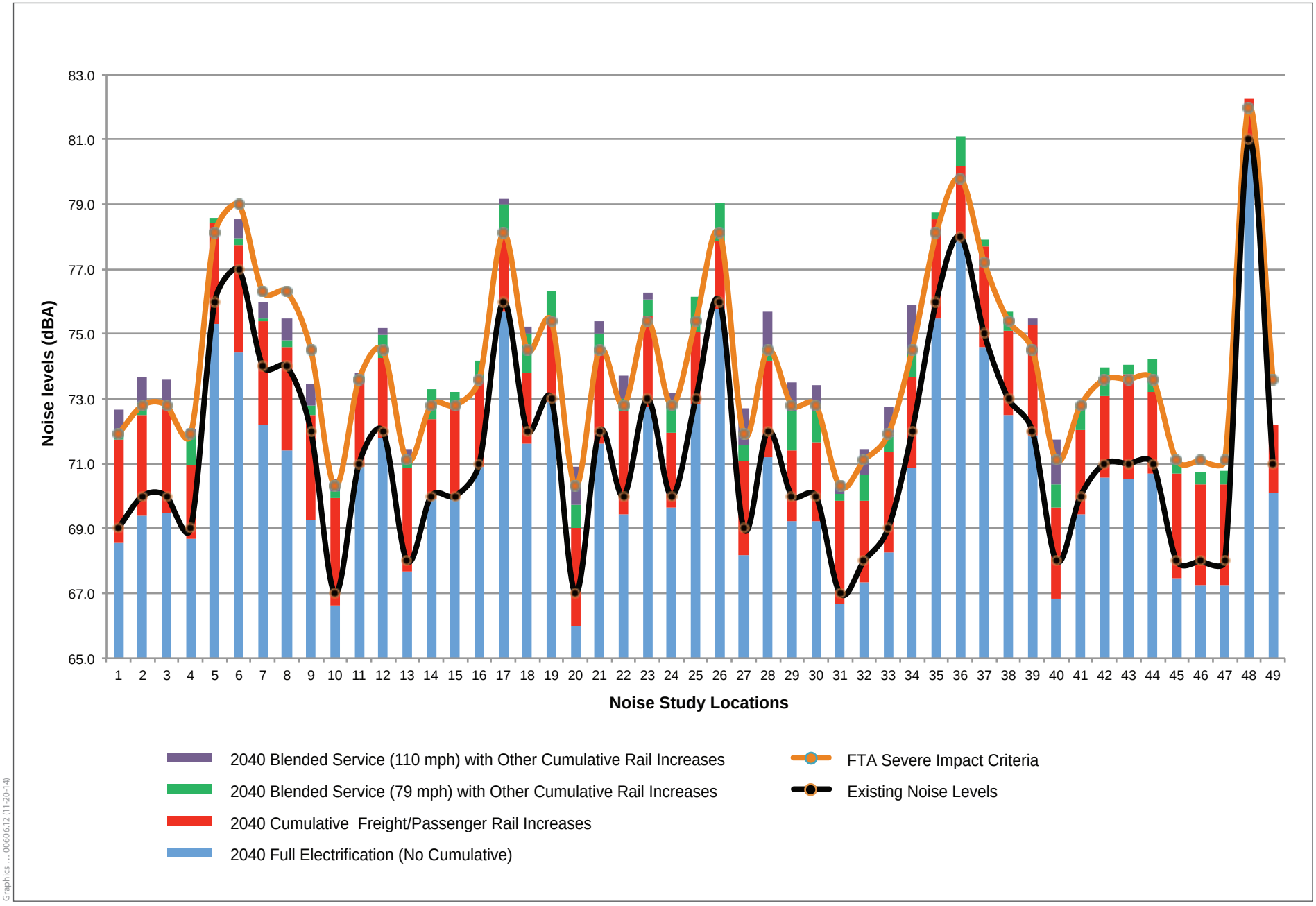
cumulative noise impacts shown in Table 4-11 and described further in Appendix C, *Noise and Vibration Technical Report*.

There are several milestones for cumulative noise.

- The first is 2020 when the PCEP service would begin. In 2020, there are three locations with significant operational noise impacts: San Mateo near the 9th Avenue grade crossing (Receptor #19); Redwood City near the Whipple Ave. grade crossing (Receptor #25); and Palo Alto near the W. Charleston Road grade crossing (Receptor #36). Caltrain's contribution to cumulative noise increase is only 0.1 dBA at each of these locations which represents 8 to 13 percent of the noise increase. The freight increases are the most substantial in terms of noise generation. There is a possibility that if the freight increases assumed in the EIR do not come to fruition that the significant impacts at one or all three of these locations would not occur and the timing for the Coast Daylight is not certain. The PCEP noise increases at this location alone would not result in significant noise impacts.
- The second is 2026 or after when HSR blended service commences. The noise analysis used a 2040 milestone, but cumulative noise would change with the combination of the PCEP, freight increases, other railroads, and high speed rail over the post-2020 period as rail service increases actually occur. As shown in Figure 4-5, the noise contributions of freight rail and other passenger rails are actually the largest source of increased noise but there would also be contributions from HSR blended service, The PCEP contribution after 2026 will depend on whether Caltrain is using all EMUs for the San Jose to San Francisco service; if so, then Caltrain will not contribute to cumulative increases. If Caltrain is still operating a similar amount of diesel locomotives as in 2020, then it would contribute approximately 0.1 dBA to the increases at these four locations: Burlingame near the Broadway grade crossing (Receptor #14): San Mateo near the 9th Avenue grade crossing (Receptor #19); Redwood City near the Whipple Ave. grade crossing (Receptor #25); and Palo Alto near the W. Charleston Road grade crossing (Receptor #36). These increases would represent only about 3 percent of cumulative noise increases in 2040.

There are a number of different methods to reduce the noise impacts of cumulative trains:

- *Wayside horns*: Train horn noise can be reduced through use of a wayside horn, which is an automatically triggered horn located at the at-grade crossing itself that sounds upon approach of a train. Because the horns are located at the crossing itself, the area of effect is smaller than the area of effect due to train horns, but sensitive receptors near the at-grade crossing will still be affected by horn noise. Wayside horns are included as one option in Mitigation Measure NOI-CUMUL-1 described below but only as part of a quiet zone. Without the quiet zone designation, train operators could still use the train horn thus defeating the purpose of a wayside horn.
- *Building sound insulation*: Another method of reducing the impact of train horn noise is building sound insulation. Sound insulation of residences and institutional buildings improve the outdoor-to-indoor noise reduction. Although this approach has no effect on noise in exterior areas, it is a feasible method for sites where noise barriers are not feasible or desirable, for buildings where indoor sensitivity is of most concern, or where the horn noise dominates the noise environment. Improvements in building sound insulation can often be achieved by adding an extra layer of glazing to the windows and by sealing any holes in exterior surfaces that act as sound leaks. Building sound insulation is included as one option in Mitigation Measure NOI-CUMUL-1 described below.



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Note: This figure replaces Figure 4-5 from the Draft EIR.

Figure 4-5
2040 Cumulative Noise Levels along Caltrain Corridor
Peninsula Corridor Electrification Project

- *Quiet zone*: The FRA has established a process by which a local jurisdiction can designate a specific area containing at-grade crossings as a "quiet zone", provided that certain supplemental safety measures (SSM) are used in place of the locomotive horn to provide an equivalent level of safety at the at-grade crossing (FTA 2006).
    - The SSMs commonly used for quiet zones include 4-quadrant gates, gates with medians or channelization devices, one-way street with gates, and street closure. By adopting an approved SSM at each of the impacted at-grade crossings, a quiet zone at least 0.5 mile long can be established.
    - Only with local implementation of the quiet zone can Caltrain, freight operators and other tenant railroad operations be relieved of the requirement to sound their horns when crossing at-grade crossings. However, following implementation of a quiet zone, if any unsafe conditions were present at the time of train passage (such as a vehicle going around the gates or pedestrians in the crossing), train operators would still have the discretion to sound train horns. Although the quiet zone regulations are silent on the issue of liability, local jurisdictions may perceived that the implementation of a quiet zone includes acceptance of potential liability in the event of related accidents. It is possible that jurisdictions may not wish to risk the potential liability associated with implementing a quiet zone and decline to do so. In such a case, Caltrain, and freight and other rail operators would continue to use train horns as a safety device in compliance with FRA requirements.
    - Although funding for quiet zone improvements is not included in the current Proposed Project budget, funding for quiet zone improvements at all remaining 42 at-grade crossings between San Jose and San Francisco is considered feasible. Assuming that quiet zone improvements may range in cost up to $1 million to $2 million per crossing, the cost of implementing quiet zone improvements could range from $42 million to $84 million.
    - Where quiet zones are implemented and accepted by local jurisdictions, cumulative noise levels may be reduced to a less than significant level at some but not necessarily all cumulatively affected locations.
    - Quiet zones are included as one option in Mitigation Measure NOI-CUMUL-1 described below.
- *Soundwalls*: Soundwalls are not considered a feasible mitigation to address horn noise because train horns are elevated and thus soundwalls would have to be as high or higher than the locomotives themselves to be effective at shielding train horn noise. Along the Caltrain corridor, such high walls would not likely be acceptable to local communities. Soundwalls cannot be placed at the at-grade crossing which also reduces their effectiveness for horn noise reduction. While lower soundwalls would help to reduce engine and wheel noise for adjacent receptors, lower soundwalls are not considered cost-effective given that they would only be partially effective at addressing train noise and would not address train horn noise which is the dominant concern.
- *Grade Separation*: While grade separations are a technically feasible way to avoid the need for train horn use, it is a highly expensive mitigation strategy. Caltrain has supported prior grade separation efforts, such as the San Bruno Grade Separation project, led by Caltrain, which will be completed in 2014. As shown in the analysis in this EIR, the San Bruno Grade Separation would reduce noise levels by approximately 2 dB compared with existing conditions. Caltrain supports future efforts at grade separation where acceptable to local communities and where local, state,

and federal funding can be obtained to fund these improvements. Grade separations can cost approximately $50 million to $100 million per crossing (grade separations can cost much more sometimes), grade separating all existing 42 at-grade crossings would cost $2.1 to $4.2 billion. The budget for the Proposed Project is $1.225 billion by comparison. Thus, Caltrain cannot commit to a comprehensive program of grade separations at this time. However, as described in Mitigation Measure NOI-CUMUL-1, Caltrain will work with local jurisdictions, transportation funding agencies, and state and federal agencies to support grade separations over time as funding becomes available.

While the recommended mitigation below, where feasible to implement, would help to reduce noise, it will take time to implement it and it may not be feasible to reduce all cumulative noise impacts to a less than significant level. Therefore, the Proposed Project, without full Caltrain EMU operations between San Jose and San Francisco, would make a considerable contribution to cumulative noise impacts, with mitigation.

As to secondary environmental impacts of Mitigation Measure NOI-CUMUL-1, the environmental effects of the different mitigation options would vary. Wayside horns and building sound insulation would have limited to no secondary environmental impacts. Quiet zone improvements would require additional construction, but the likely environmental impacts of such construction are limited given the limited footprint of four-quadrant gates, active warning systems, medians and street work. In general, construction impacts for quiet zone improvements would be similar to the impacts disclosed for Proposed Project construction, would occur in previously developed and disturbed areas, and would be temporary in nature. The applicable Proposed Project mitigation described for construction impacts in this EIR, where relevant, would also be applied to quiet zone improvements.

As to grade separations, the design and feasibility of a select number of future grade separations are unknown and unstudied at this time, and thus the specific environmental impacts cannot be identified. While they are statutorily exempt from CEQA review, grade separations may nevertheless have substantial environmental impacts depending on their design and location, and their construction can be highly disruptive. Therefore, as a conservative assumption, their secondary environmental impacts are assumed to be significant and unavoidable.

Caltrain will work with other parties when implementing this measure to apply the relevant construction mitigation measures identified in this EIR to these the implementation of future noise mitigation improvements. Based on the analysis to date, the Proposed Project and Caltrain Full Electrification are the minor sources of cumulative increases in noise compared with existing conditions; therefore, pursuant to CEQA, Caltrain is only responsible for that portion of the cumulative increases caused by the Proposed Project (or in the future with full electrification). Other sources of cumulative increases including HSR, other passenger rail and freight services as well as non-rail sources near the Caltrain corridor would also bear responsibility for cumulative noise increases.

Mitigation Measure NOI-CUMUL-1 would address Caltrain's contribution to this cumulative impact. However, given the long-term nature of these improvements, the lack of current funding, the shared responsibility for cumulative impacts, and the lack of a collective agreement for a comprehensive noise mitigation program, it may not be possible to implement noise mitigation measures prior to cumulatively significant noise increases. In addition, the secondary environmental effects of some improvements, particularly for any grade separations constructed in the future, may be significant

and unavoidable. Thus, the Proposed Project is considered to contribute considerably to a cumulatively significant noise impact, even with mitigation.

Mitigation Measure NOI-CUMUL-1: Implement a phased program to reduce cumulative train noise along the Caltrain corridor as necessary to address future cumulative noise increases over FTA thresholds

The JPB, in cooperation with other rail operators, local jurisdictions, transportation funding agencies, and state and federal agencies, will support incremental noise reduction measures at the locations of cumulative noise impacts over time as funding becomes available for the locations where the PCEP would contribute to cumulative noise impacts. Where the PCEP does not contribute to cumulative noise impacts or where it would lower existing noise levels, then the PCEP is not responsible to participate in mitigation, even if the cumulative noise impacts due to other rail service increase is significant. Caltrain will work with local, state, and federal partners to establish priorities for noise reduction measure to be implemented as funding becomes available. Caltrain will also work with other rail operators to seek funding participation from multiple parties on a fair-share basis in proportion to their cumulative noise contributions.

The costs for implementing the phased program shall be borne by all rail operators in proportion to their contributions to cumulative train noise increased over existing conditions. Given that there are multiple contributors to cumulative rail noise, the JPB is only responsible to fund its fair share for necessary noise mitigation with other rail services responsible to fund their fair share as well. Fair share shall be determined by the noise contribution of each rail service increase over existing conditions (2013) to cumulative noise levels as determined using acceptable FTA noise modeling protocols.

As noted above, the Proposed Project would result in increased ~~increases~~ noise at four ~~six~~ of the 49 study locations in the 2020 cumulative scenario (but only three locations would have cumulatively significant noise increases in 2020), but if Caltrain implements full electrification (e.g. 100 percent EMU service from San Jose to San Francisco), then the combined effect of the Proposed Project and full electrification would ~~only~~ not result in noise increases at any ~~one~~ of the 49 study locations and no fair-share contribution would be necessary from Caltrain.

This program is expected to be implemented over a period of decades. Improvements will be phased as needed to address changes in cumulative rail service over time and cumulative rail noise.

- The first cumulative milestone is 2020. The PCEP would contribute to significant cumulative impacts at three locations with PCEP contributions ranging from 8 to 13 percent: San Mateo near the 9th Avenue grade crossing (Receptor #19); Redwood City near the Whipple Avenue grade crossing (Receptor #25); and Palo Alto near the W. Charleston Road grade crossing (Receptor #36). At these locations, the cumulative noise increases identified in the EIR are the combination of the PCEP, assumed freight increases, and potential Coast Daylight service. Caltrain will monitor freight levels as well Coast Daylight planning in the time leading up to 2020. Caltrain will work with UPRR and Amtrak, as necessary, to coordinate fair-share contributions to cumulative mitigation and plan for implementation of feasible improvements by 2020 or by such period that cumulative noise at the three locations above is expected to exceed the FTA moderate threshold criteria. Since the PCEP increases are only a small portion of the cumulative impact in 2020, the fair-share contributions of other

parties will need to be secured to implement potential mitigation. If the other parties are not willing to contribute their fair-share, then mitigation may not be feasible.

- The second cumulative milestone is 2026 or after when HSR blended service first commences along the Caltrain corridor. If Caltrain replaces all remnant diesel equipment by that time, then the PCEP would make no contribution to cumulative noise increases and would have no further mitigation responsibilities (operating up to 79 mph). If Caltrain is still operating a similar amount of diesel locomotives in 2026 or after as in 2020, then it would contribute approximately 3 percent to the increases at these four locations: Burlingame near the Broadway grade crossing (Receptor #14): San Mateo near the 9th Avenue grade crossing (Receptor #19); Redwood City near the Whipple Ave. grade crossing (Receptor #25); and Palo Alto near the W. Charleston Road grade crossing (Receptor #36). These four locations would all be affected by the PCEP, HSR, freight, and the Coast Daylight and the Palo Alto location could also be affected by Dunbarton Rail Corridor service. The subsequent project-level analysis of blended HSR service may refine the noise increases due to HSR and blended service when project level design details are taken into account. Caltrain's fair share responsibility for blended service with Caltrain EMUs operating up to 110 mph may exceed the PCEP's noise contribution since the PCEP is limited to 79 mph. Projected freight and other passenger rail increases may or may not occur. Caltrain will monitor freight levels changes and will work with CHSRA, UPRR, and Amtrak (and DRC sponsors if DRC is advanced) as necessary, to coordinate fair-share contributions to cumulative mitigation and plan for implementation of feasible improvements by 2026 or by such period that cumulative noise at the four locations above will exceed the FTA moderate threshold criteria. Since the PCEP increases are only a small portion of the cumulative impact, the fair-share contributions of other parties will need to be secured to implement potential mitigation. If the other parties are not willing or able to contribute their fair-share, then mitigation may not be feasible, although it is assumed that CHSRA will be able to secure sufficient funding to support mitigation to address HSR noise fair-share impacts.

~~Wayside horns and~~ Residential building sound insulation.

The, JPB, in cooperation with the other parties noted above, shall evaluate the potential to reduce cumulative noise impacts through the installation of ~~wayside horns and~~ building sound insulation improvements at residences projected to have a sound increase greater than the FTA moderate impact criteria. Building sound insulation methods may include extra wall insulation, window glazing and sealing of exterior surfaces.

If this option is selected, a technical study shall be completed to evaluate the effectiveness of reducing cumulative impacts to less than the FTA moderate impact threshold through these methods. If the study shows that it is feasible to reduce the impact to less than the threshold at a cumulatively affected sensitive noise receptor, then no additional mitigation at that location will be required. Building sound insulation measures shall only be installed to the extent necessary to meet the impact threshold at the receptor location and shall only be installed if building owners are willing to accept such measures.

Quiet Zones

The lead agency for a quiet zone designation is the local jurisdiction (typically the City or County) that is responsible for traffic control and law enforcement on the roads at the at-grade crossings.

The JPB, in cooperation with the other parties noted above, and the affected local jurisdictions shall implement a phased program considering the potential establishment of quiet zones along the Caltrain corridor at all locations where cumulative train noise is predicted to exceed FTA moderate impact thresholds. The JPB and other cooperating railroad operators will work closely with local jurisdictions to prepare the engineering studies and coordination agreements to design, construct, and enforce potential quiet zones.

Options for establishing quiet zones could include implementation of the following FRA pre-approved supplemental safety measures (SSM):

- Four-quadrant gate system. This measure involves the installation of at least one gate for each direction of traffic to fully block vehicles from entering the crossing.
- Gates with medians or channelization devices. This measure keeps traffic in the proper travel lanes as it approaches the crossing, thus denying the driver the option of circumventing the gates by travelling in the opposite lane.
- One-way street with gates. This measure consists of one-way streets with gates installed so that all approaching travel lanes are completely blocked. This option may not be feasible or acceptable to local jurisdictions at all locations.
- Road closure. This measure consists of closing the road to through travel at the at-grade crossing. This option may not be feasible or acceptable to local jurisdictions at all locations.

In addition to these pre-approved SSMs, the FRA also identifies a range of other measures that may be used to establish a quiet zone. These could be modified SSMs or non-engineering measures which might involve law enforcement or public awareness programs. Such alternative safety measures must be approved by the FRA based on the prerequisite that they provide an equivalent level of safety as the sounding of horns.

Wayside horns can also be utilized as part of a quiet zone. While not avoiding the sounding of a horn, wayside horns affect a smaller area than train-mounted horn. Wayside horns can be used when the other measures above are not adequate to avoid the use of a horn.

The lead agency for a quiet zone designation is the local public authority which is the only authority that can implement a quiet zone. Caltrain or the other rail operators cannot on their own designate the quiet zone. However, only with the implementation of the quiet zone can Caltrain, other tenant railroads and freight operators be relieved of the requirement to sound their horns when crossing at-grade crossings. One key aspect of local jurisdiction acceptance of a quiet zone is acceptance of potential liability in the event of accidents related to not sounding a horn at an at-grade crossing after the installation of any required SSMs. Thus, if a local city does not accept the quiet zone, then even if the required SSMs are present, Caltrain, freight and other rail operators would continue to use train horns as a safety device in compliance with FRA requirements.

Grade Separations

Caltrain, in cooperation with other rail operators, local jurisdictions, transportation funding agencies, and state and federal agencies, will support incremental grade separations at locations of cumulative noise impacts over time as funding becomes available. Caltrain will work with local, state, and federal partners to establish priorities for grade separations to be implemented

as funding becomes available. Caltrain will also work with other rail providers to seek funding participation from multiple parties on a fair-share basis in proportion to noise contributions.

Costs

The specific costs are not known for this mitigation. As noted in the EIR, grade separations can cost $50 million to $100 million or more per location (42 locations could cost $2.1 to 4.2 billion) and quiet zone treatments can cost $1 million to $2 million per location (42 locations could cost $42 to $84 million). Building insulation costs have not been estimated.

Operational Vibration

The thresholds used for this analysis are the FTA annoyance thresholds for residential receptors (72 VdB) and institutional buildings (75 VdB) and the structural damage threshold (100 VdB). As described by the FTA (2006), it is very rare for transportation-generated ground vibration to approach building damage levels. Thus, the primary focus of this cumulative analysis is on the annoyance thresholds.

Unlike noise, which is measured on a 24-hour day-night basis in which noise levels can increase cumulatively, vibration levels do not accumulate. Thus cumulative impacts would not result in higher vibration levels when combining multiple trains along the corridor. However, cumulative impacts can occur when multiple trains, each over the FTA vibration annoyance thresholds, pass a single sensitive receptor, resulting in an increase the number of annoyance events.

As presented in Table 3.11-4 in Section 3.11, *Noise and Vibration*, existing vibration levels for Caltrain's diesel service at 50 feet from the outermost track vary from 72 to 80 VdB, depending on local site conditions and speed. This range would be representative of continued diesel operations for Caltrain as well as predicted increases in cumulative diesel passenger rail operations for other tenant railroads (ACE, Capitol Corridor, etc.). As presented in Table 3.11-5 in Section 3.11, *Noise and Vibration*, existing vibration levels for freight at 100 feet from the outermost track vary from 73 to 81 VdB, which is considered representative for future freight service increases.

These existing levels exceed FTA annoyance thresholds of 72 VdB for immediately adjacent residences and of 75 VdB for immediately adjacent institutional buildings, but none approach structural damage thresholds.

Blended Service Scenario (79 mph scenario)

As described in the Final EIS/EIR for the HSR Merced-Fresno segment, HSR projects typically generate significantly fewer vibration impacts as compared with noise impacts (CHSRA 2012d). Using FRA reference level of 83 VdB for 150 mph high-speed rail trains at 50 feet from track centerlines (FRA 2012) and adjusting to a 79 mph speed, potential vibration levels are generically estimated as 77 VdB which would be within the range of existing train vibration levels along the corridor today. This estimate has not been adjusted for site trackage or soil conditions or any potential track improvements that may come with Blended Service and thus may overestimate actual vibration levels for HST trains. For example, for the HSR Merced – Fresno segment, vibration levels for speeds up to 150 mph at 50 feet from the HSR track centerline were estimated as approximately 72 VdB for (CHSRA 2012d). Based on the HSR Merced-Fresno vibration distance curves and adjusting downward for 79 mph speeds, vibration levels could be 66 VdB instead if similar vibration conditions (soil, trackage, etc.) were present along the Caltrain corridor as that presumed for HSR for the Merced Fresno segment.

The additional cumulative diesel traffic (ACE, DRC, Capitol Corridor, Amtrak and freight) would not increase vibration levels along the Caltrain ROW compared with existing conditions (which already includes diesel freight and passenger rail operations). Over time, these services are likely to replace their older equipment as it reaches the end of its design life and it is possible, but unknown, that new equipment may be somewhat quieter than existing equipment.

As noted in Section 3.11, *Noise and Vibration*, using FTA vibration reference levels (FTA 2006) for rapid transit trains (which FTA guidance recommends for electric commuter trains), vibration levels with Caltrain EMUs could be 73 Vdb at 50 feet from the outermost track at 50 mph. Adjusting to 79 mph level, the vibration levels for the new Caltrain EMUs could be 77 VdB at 79 mph. This level is within the range of existing vibration levels along the Caltrain corridor noted above.

Based on the information presented above, cumulative train service (including HSR, the Proposed Project, Caltrain Full Electrification, ACE, Capitol Corridor, DRC, Amtrak and freight) would not change the overall range of vibration levels along the Caltrain corridor.

According to the FTA Noise and Vibration Manual (FTA 2006), in heavily used corridors, if the existing train vibration exceeds the FTA annoyance impact criteria (as noted above), the project will cause additional impact if the project significantly increases the number of vibration events defined as approximately doubling the number of events. Thus, the analysis then examined whether the increase in the number of cumulative vibration events is or is not significant.

As noted in Table 4-8, if all the cumulative train service increases proposed would come to full fruition, in 2040, the number of trains (including Blended Service) between Santa Clara and San Francisco would more than double. Given the more than doubling of trains along the Santa Clara to San Francisco segment of the Caltrain corridor, a potentially cumulative significant increase in the number of vibration annoyance events for residential and institutional building receptors is identified.

The number of trains between San Jose and Santa Clara using the Caltrain ROW itself would increase by over 50 percent and between Tamien and Diridon by just under 50 percent under cumulative 2040 conditions, but these sections would not include HST operations since the HST would operate on a dedicated separate track south of Santa Clara. Between Santa Clara and San Jose Diridon, HSR would be on an aerial or in a tunnel. South of Diridon, HSR would be on an aerial structure to south of Tamien Station, then on a mix of aerial and at-grade to Capitol Expressway. Where on aerial structures, based on analysis in the HSR Merced-Fresno EIR/EIS (SCHRA 2012d), vibration levels are much less that an at-grade section. Vibration from tunnels depends on soil conditions and tunnel design and thus cannot be assessed at this time, but will be assessed by CHSRA for the Blended Service environmental evaluation if a tunnel is used from San Jose to Santa Clara. For the at-grade HSR segment south of the Tamien Station to Pullman Way where the HSR alignment is along the Caltrain ROW, HSR vibration could also contribute additional vibration.

Although HSR would operate on a separate dedicated track south of Santa Clara, if one includes 80 trains (one-way) per day and given the parallel alignment to the Caltrain ROW in some locations,

there is a possible doubling of vibration events, and potential cumulative vibration impacts are also identified south of Santa Clara.[18]

Blended Service Scenario (110 mph scenario)

In addition to train service level increases, HSR and Caltrain EMUs could operate at speeds up to 110 mph with Blended Service.

Using FRA reference level of 83 VdB for 150 mph high-speed rail trains at 50 feet from track centerlines (FRA 2012) and adjusting for 110 mph speeds, potential vibration levels for HSR trains are generically estimated as 80 VdB. As noted above, this generic vibration level estimate has not been adjusted for site trackage or soil conditions or any potential track improvements that may come with Blended Service and thus may overestimate actual vibration levels for HST trains. For example, for the HSR Merced – Fresno segment, vibration levels for speeds up to 150 mph at 50 feet from the HSR track centerline were estimated as approximately 72 VdB for (CHSRA 2012d). Based on the HSR Merced-Fresno vibration distance curves and adjusting downward for 110 mph speeds, vibration levels could be 69 VdB instead if similar vibration conditions (soil, trackage, etc.) were present along the Caltrain corridor as that presumed for HSR in this segment.

Both the Merced to Fresno and Fresno to Bakersfield HST project-level environmental documents identified significant vibration effects (related to exceedance of the annoyance thresholds, not structural damage) to a limited number of adjacent residences (close to the HST corridor) and included mitigation design measures that would be employed (options identified included increased maintenance, special trackwork, vehicle suspension design, track support systems, building modifications, trenches and buffer zones) (CHSRA 2012d, 2012e). However, since these segments are projected to operate at speeds in excess of 200 mph and Blended Service studied in this EIR is studied only up to 110 mph, the conclusions for much higher speeds in these prior studies are not considered representative for conditions for Blended Service for the Caltrain corridor.

Based on the FTA Reference levels for rapid transit trains at 50 mph (FRA 2006) and adjusting for 110 mph speeds, HSR EMUs could have vibration levels of 80 VdB at 50 feet from the outer track centerline which would be the same as the generic estimate for HSR trains described above and would be similarly at the top of the range of existing vibration levels along the corridor. This estimate also has not been adjusted for track improvements that will be necessary to operate at speeds up to 110 mph and thus may overestimate the actual value.

Thus, at this time, it appears likely that Blended Service would not increase overall vibration levels compared with the range of vibration levels along the Caltrain corridor today and it is distinctly possible that vibration levels for Blended Service would be lower than the generic estimates presented above when specific trackage improvements required to allow 110 mph speeds are made and when site-specific considerations are taken into account.

However, as noted above for the Blended Service 79 mph scenario, cumulative train events would more than double between Santa Clara and San Francisco. Cumulative train events would also more than double south of Santa Clara if including HST service on separate dedicated trackage where

[18] Whether cumulative impacts would actually occur would depend on the specific design of tracks from south of Tamien Station to Santa Clara and the specific vibration characteristics of HSR trains and trackage. The identification of a potential cumulative vibration impact is preliminary and based on worst-case assumptions. As noted above, vibration levels for HST may be much lower than generic FTA reference level derived estimates and aerial structure vibration should be much less than at-grade segments.

along the Caltrain ROW. Thus, there is a potentially significant increase in annoyance due to cumulative vibration events for residents and institutional buildings immediately adjacent to the Caltrain ROW for the 2040 Blended Service 110 mph scenario.

Other Non-Rail Projects

Operation of the land developments would not likely have substantial effects on vibration levels due to traffic generation involving light duty and passenger vehicles. Increased vibration along roadways may occur in in locations in very close proximity to heavy-truck traffic but would not otherwise be expected to be a significant impact. In addition, land development projects along the Caltrain ROW would also introduce more sensitive receptors that would be subject to the cumulative vibration levels resulting from increased passenger and rail service described above.

Proposed Project Cumulative Contribution

As discussed in Section 3.11, *Noise and Vibration,* the Proposed Project would not change existing vibration levels along the Caltrain Corridor due to replacement of diesel trains with EMUs which, if anything, would likely have less vibration than existing diesel-locomotive trainsets they replace. As described in Section 3.11, *Noise and Vibration*, using FTA vibration reference levels (FTA 2006) for rapid transit trains (which FTA guidance recommends for electric commuter trains), vibration levels with EMUs could be 73 Vdb at 50 feet from the outermost track at 50 mph. Adjusting to 79 mph, the vibration levels for the new EMUs could be 77 VdB at 50 feet which is in the middle of the range of existing vibration levels along the Caltrain corridor noted above.

As noted in Section 3.11, *Noise and Vibration*, the TPFs would not generate significant vibrations and thus would not contribute to any cumulative vibration impacts.

Although the Proposed Project would have vibration levels within the range of existing levels, the Proposed Project would add 22 trains per day to the Santa Clara to San Francisco segment, which in combination with cumulative rail increases (described above) would result in a more than doubling of the train vibration events along this segment, which is considered a significant increase per the FTA criteria. South of Santa Clara, cumulative train vibration event increases may also be significant if including HST operations on separate dedicated track. Thus, the Proposed Project would have a considerable contribution to a significant cumulative increase in train vibration effects for the 2040 Blended Service 79 mph scenario.

For the 2040 Blended Service 110 mph scenario, Caltrain EMUs with full electrification would have vibration levels within the range of existing vibration levels along the Caltrain corridor and thus would not increase vibration levels. However, similar to the conclusion for the 2040 Blended Service 110 mph scenario, the Proposed Project and Caltrain Full Electrification would contribute to a significant increase number of train vibration events along the corridor.

Potential vibration reduction measures identified in prior environmental evaluations for the high-speed rail system are noted in Table 4-14.

Table 4-14. Potential Vibration Mitigation Procedures and Descriptions from the CHSRA Merced to Fresno EIS/EIR

Mitigation Procedure	Location of Mitigation	Description
Location and Design of Special Trackwork	Source	Careful review of crossover and turnout locations during the preliminary engineering stage. When feasible, relocate special trackwork to a less vibration-sensitive area. Installation of spring frogs eliminates gaps at crossovers and helps reduce vibration levels.
Vehicle Suspension	Source	Rail vehicle should have low unsprung weight, soft primary suspension, minimum metal-on-metal contact between moving parts of the truck, and smooth wheels that are perfectly round.
Special Track Support Systems	Source	Floating slabs, resiliently supported ties, high resilience fasteners and ballast mats all help reduce vibration levels from track support system (see further discussion of track support options in Appendix C, *Noise and Vibration Technical Report*).
Building Modifications	Receiver	For existing buildings, if vibration-sensitive equipment is affected by train vibration, the floor upon which the vibration-sensitive equipment is located could be stiffened and isolated from the remainder of the building. For new buildings, the building foundation should be supported by elastomer pads similar to bridge bearing pads.
Trenches	Along Vibration Propagation Path	A trench can be an effective vibration barrier if it changes the propagation characteristics of the soil. It can be open or solid. Open trenches can be filled with materials such as styrofoam. Solid barriers can be constructed with sheet piling, rows of drilled shafts filled with either concrete or a mixture of soil and lime, or concrete poured into a trench.
Buffer Zones	Receiver	Negotiate a vibration easement from the affected property owners or expand rail right-of-way.

Source: CHSRA 2012d

Unlike the proposed Merced-Fresno HSR segment, the Caltrain corridor is an existing rail system and, thus, the applicability of these options to the Caltrain corridor will vary as discussed below:

- Location and Design of Special Trackwork: Relocation of existing special trackwork is not applicable to the Caltrain corridor because the locations of the existing crossovers and turnouts are determined by the existing track configuration.
- Special Track Support Systems: These systems could be applied to the Caltrain corridor if needed, but these options are significant capital projects and funding would need to be secured.
- Vehicle Suspension: The vehicle suspension measure described in Table 4-14 is for high-speed rail vehicles only.
- Building Modifications: The building modification measure is feasible for the Caltrain corridor where needed.
- Trenches: As described in Appendix C, *Noise and Vibration Technical Report*, this is an experimental method and there are several major issues that must be overcome, including

structural concerns and the need for up to 60 feet of area adjacent to the tracks that would raise substantial ROW concerns along the constrained Caltrain ROW. Further, as of the time of this Draft EIR (February 2014), WIA is not aware of any successful installations in North America.

- Buffer Zones: The applicability of the buffer zone option will need a site-specific assessment. There is a built environment generally up to the Caltrain ROW and buffer zones could be disruptive to the existing environment in constrained locations.

While some of the measures in Table 4-14 are not applicable to the Caltrain corridor, as discussed above, given the range of options available, there are feasible means to reduce the cumulative vibration impacts. Thus, Mitigation Measure NOI-CUMUL-2 would ~~help to~~ reduce the Proposed Project's contribution to a less-than-significant level.

Given the preliminary state of design for the Blended Service improvements, the specific vibration treatments that may be necessary have not been identified at this time. Depending on the measures actually proposed, there may be secondary physical impacts due to their construction, but these impacts should be limited to the Caltrain ROW and the area of any passing tracks (if outside the Caltrain ROW). Evaluation of potential secondary physical impact of track or other improvements necessary to address significant Blended Service vibration effects should be included in the separate environmental evaluation of Blended Service by CHSRA.

Mitigation Measure NOI-CUMUL-2: Conduct project-level vibration analysis for Blended System operations and implement vibration reduction measures as necessary and appropriate for the Caltrain corridor

As noted above, the vibration analysis in this document uses worst-case assumptions. A project-level vibration analysis will be completed by CHSRA for both the San Jose to Merced segment and the Blended Service segment north of San Jose. If subsequent environmental evaluation by CHSRA shows that significant cumulative increases in vibration would not occur along the Caltrain ROW when considering the specific track improvements and HSR and Caltrain EMU design, then this mitigation would not be required or may only be required in certain locations.

A significant cumulative impact would only occur when the number of vibration events approaches a doubling of existing conditions. These measures are only necessary to be in place by the time Blended Service operates on the Caltrain corridor north of Santa Clara or when HSR operates on dedicated track south of Santa Clara (to 2 miles south of Tamien Station).

Based on the 2014 Business Plan, the earliest date for HSR blended service operations on the Caltrain corridor north of Santa Clara and south of Santa Clara on dedicated track would be 2026. Caltrain will coordinate with CHSRA during the subsequent environmental process for blended service to examine the actual potential for significant cumulative vibration impacts to actually occur and the need for mitigation.

~~If necessary~~ If the subsequent environmental evaluation shows significant cumulative vibration impacts taking into account the specific blended service track improvements, the JPB, in cooperation with CHSRA and other rail operators will support incremental train vibration reduction measures along the Caltrain ROW. Caltrain will work with CHSRA and other rail operators to establish priorities for vibration reduction measure to be implemented as funding becomes available. The timing for any necessary improvements should be combined with blended service track improvements and should occur prior to a doubling of vibration events

Based on the 2014 Business Plan, HSR operations would commence in 2026 which would double the vibration events and thus mitigation should be in place at that time.

Potential vibration reduction measures could include, but are not limited to, special track support systems, vehicle suspension (HSR vehicles only), building modifications, trenches (if feasible), and buffer zones.

The costs for implementing the phased program should be borne by all rail operators in proportion to their contributions to increased vibration events and/or levels. Given that there are multiple contributors to cumulative rail vibration events, the JPB is only responsible to fund its fair share for necessary vibration reduction measures with other rail services responsible to fund their fair share as well. However, if there is no governmental approval that triggers an obligation to share such costs, it may be impossible to require other railroads to pay their fair-share. Fair-share shall be determined by the vibration train event increases over existing conditions (2013).

4.1.4.13 Population and Housing

Impact CUMUL-12-POP: Cumulative impact to population and housing

As discussed in Section 3.12, *Population and Housing*, the Proposed Project would not have any impacts on population or housing during construction or operations; therefore, the Proposed Project would not contribute to housing and population impacts in the three counties.

4.1.4.14 Public Services and Utilities

Impact CUMUL-13-PSU: Cumulative impacts related public services and utilities

The geographic context for the analysis of cumulative construction impacts to public services and utilities is the Caltrain ROW and adjacent areas. The geographic context for the cumulative analysis of operation-related public services and utilities impacts includes the service areas of regional utilities and service providers to the project sites. For construction disruption to utilities and public services, only the cumulative projects in Table 4-3 are included in the analysis. For operational impacts to utilities and public services, the general growth projections summarized in Table 4-2 were used.

Public services are defined to include schools, fire protection, police protection, wastewater treatment or other such public facilities. Utilities are defined to include water supply, electrical supply, and natural gas supply which are typically provided by utility agencies or companies. Landfill capacity is separately addressed.

For construction, the analysis addressed potential for utility disruption, temporary public service demands and impacts to landfill capacity. For operations, the analysis addresses operational public service and utility demands relative to the potential need for new public service facilities and utility infrastructure as well as operational impacts to landfill capacity.

Impacts regarding emergency response times are addressed separately above in the discussion of Hazards and Hazardous Materials.

Construction

Disruption to utilities

During construction, cumulative projects could disrupt utility service systems in a planned or unplanned manner. Standard construction practices and regulations require construction contractors to identify and avoid unplanned disruptions to utilities and to work with utility owners to coordinate construction to avoid damage and utility outages. However, there would remain a small potential for multiple utility disruptions due to construction activities resultant from cumulative projects that occur at the same time.

As discussed in Section 3.13, *Public Services and Utilities*, earth moving activities for the installation of the OCS poles, and TPFs could temporarily disrupt utility service systems. However, with the implementation of Mitigation Measures PSU-8a, PSU-8b, and PSU-8c, which require JPB coordination with all utility providers, adjustment of OCS pole locations (as necessary to minimize utility conflicts), and scheduling and notification requirements, the Proposed Project would minimize potential disruptions to utilities and thus would make a less than considerable contribution to any potential cumulative impacts during construction.

Public Services

During the construction of cumulative projects, there could be a temporary distributed increased demand for public services across the San Francisco Peninsula. However, the region already accommodates substantial construction projects across the entire Peninsula and the overall level of construction, considered on a regional scale, is not expected to substantially change with the cumulative projects compared with existing conditions. Therefore, the overall change in demand in public services is not expected to result in the need for new or physically altered public facilities and, thus, result in any potential secondary environmental impacts associated with construction of new public facilities.

As discussed in Section 3.13, *Public Services and Utilities*, because the Proposed Project would neither directly displace public facilities nor result in substantial changes in local population and demand for public services, construction of the Proposed Project would make a less-than-considerable contribution to any potential cumulative impacts on public services and facilities during construction.

Landfill Capacity

Construction of the cumulative projects would generate solid waste. Construction waste would include soils from grading and excavating activities, construction and demolition material, and other solid waste. Cumulative growth in the region will also result in increased solid waste generation. As explained in the EIR for *Plan Bay Area* (MTC/ABAG 2013b), all but four of the 17 landfills in the San Francisco Bay Area have an estimated closure date before the year 2040 and it is unlikely the four remaining landfills can handle the region's solid waste disposal. As a result, construction of cumulative projects would contribute to the reducing capacity of regional landfills over time.

As described in Section 3.13, *Public Service and Utilities*, the only solid waste expected to result from project construction would be soil resulting from grading and excavation associated with construction of TPFs and OCS foundations as well as general packaging and other materials associated with construction materials and construction workers. Any uncontaminated soil that is not reused onsite would be recycled in accordance with the various state and local ordinances

governing recycling. Contaminated soil would be disposed at facilities approved to receive such soil, as discussed in Section 3.8, *Hazards and Hazardous Materials*. While there are long-term concerns for landfill capacity by 2040, as explained in the EIR for *Plan Bay Area* (MTC/ABAG 2013b), 12 of the current 17 major landfills in the Bay Area will still be open through 2020 ~~2019~~, including the Guadalupe Sanitary landfill and Kirby Canyon Landfill (both in Santa Clara County). Other construction waste is expected to minimal and readily handled by existing landfill facilities in the region, which have ample remaining capacity for such material in the aggregate. Thus, while long-term growth in the region will require the construction of additional landfill by 2040 to accommodate future solid waste, the Proposed Project's contribution to any cumulative impacts on landfill capacity would be less than considerable.

Operation

Demand for Additional Utility Infrastructure

Operation of cumulative projects could increase demands for additional utility infrastructure including water supply, electrical supply and natural gas supply. New transportation projects, including Blended Service, BART Silicon Valley extension, and extension of light-rail systems would increase cumulative demand for electricity. Land use projects and general regional growth will increase water, electricity, and natural gas demands. The cumulative demands for utility service could result in the need for additional utility infrastructure including electricity generation plants and transmission facilities, development of additional water supplies and distribution infrastructure as well as additional natural gas supply and transmission. Depending on where the new infrastructure is required, this could result in significant impacts on the environment during construction of such new facilities.

As discussed in Section 3.13, *Public Services and Utilities*, the Proposed Project will require the relocation of some existing utilities crossing the Caltrain ROW or along the location of the ductbanks connecting the TPSs to the Caltrain ROW and will also require construction of electrical transmission connections from PG&E substations to the two TPSs. The relocation of these utilities or the construction of electrical transmission connections could result in secondary environmental impacts. At this time, the Proposed Project is not expected to result in the need for additional PG&E power generation or transmission facilities upstream of the local substations that would connect to the TPSs. Thus, the Proposed Project could contribute to cumulative demands for new utility infrastructure relative to the local utility relocations and the local transmission facility extensions. Under Mitigation Measure PSU-9, the JPB will work with utility owners and local jurisdictions to apply the relevant applicable mitigation identified for construction of the Proposed Project when conducting local utility relocations or local transmission line extensions made necessary by the Proposed Project. With this mitigation, the Proposed Project would make a less-than-considerable contribution to any potential cumulatively significant utility infrastructure demands.

Public Services

Operation of cumulative projects could increase demands for additional public services including fire, police, schools and other public facilities. New transportation projects, including Blended Service, BART Silicon Valley extension, and extension of light-rail systems would increase cumulative demand for electricity. Land use projects and general regional growth will increase demands for fire, police, schools and other local public community facilities. The cumulative demands for public service could result in the need for additional public service facilities including

new police stations, fire stations, schools, or other public community facilities. Depending on where the new facilities are proposed, this could result in significant impacts on the environment during construction and operation of new public facilities.

As discussed in Section 3.13, *Public Services and Utilities*, the Proposed Project is not expected to result in increased demand for police, fire, school, or other public facilities compared with existing conditions because the Proposed Project would not result in population growth and would not fundamentally change conditions of the Caltrain ROW in a way that increases demand for public services. For these reasons, the contribution of the Proposed Project to any potential cumulatively significant on public service demands that might result in the need for construction of additional public service facilities would be less than considerable.

Landfill Capacity

General growth in the region would generate additional solid waste. As noted above, only a few (four) of the existing landfills have a closure before 2040 and it is unlikely these four can handle the region's solid waste disposal in 2040. As a result, cumulative project operations would contribute to reducing capacity of regional landfills over time.

Operation of cumulative transportation projects would have a limited increase in the demand for landfill capacity because they generally do not generate large amount of solid waste overall. However, operation of the cumulative land use developments would generate solid waste. Over time, combined with general regional growth, there will be a need for new landfills, the construction of which might result in significant environmental impacts.

As discussed in Section 3.13, *Public Services and Utilities*, with the Proposed Project, normal EMU operations would not result in substantial new generation of solid waste above that associated with servicing of diesel locomotives today. Similarly, maintenance of the OCS and TPFs would not involve the generation of large amounts of solid waste. There would be a minor increase in solid waste production associated with the Proposed Project from increased ridership (e.g., disposable coffee cups, newspaper) but the volumes of waste would not be substantial relative to landfill capacity. Therefore, Proposed Project operations would result in a less-than-significant solid waste generation and would make a less-than-considerable contribution to any potential cumulatively impacts on landfill capacity.

4.1.4.15 Transportation/Traffic

Impact CUMUL-14-TRA: Cumulative effects to transportation and traffic

The geographic context for the analysis of cumulative construction and operation-related public varies by subject area. For construction disruption, the geographic area is the Caltrain ROW and vicinity. For operational impacts to traffic level of service, and bicycle and pedestrian facilities, the geographic focus of the analysis is the roadways/intersections at the at-grade crossings and near Caltrain stations. For regional impacts to traffic and transit systems, the geographic area is the San Francisco Peninsula.

For construction disruption to transportation and traffic, only the cumulative projects in Table 4-3 are included in the analysis. For operational impacts to transportation and traffic, the general growth projections summarized in Table 4-2 were used in combination with assumptions about

cumulative transportation improvements (see Appendix I, *Ridership Technical Memorandum*) to drive ridership, traffic modeling analysis, and other operational impact analysis.

Construction

Disruption of transportation facilities and systems

During construction, cumulative projects could disrupt roadway, transit, pedestrian, bicycle, parking or access facilities in a planned or unplanned manner. Standard construction practices and regulations require construction contractors to identify, avoid, and minimize unplanned disruptions to transportation facilities and system and work with public works departments, transportation agencies, and system operators to coordinate construction to avoid substantial delays or disruption in access, service and travel.

Rail, transit, and vehicle access and movement could be disrupted during construction of Blended Service station improvements, passing tracks, and other facilities (such as grade separations, if proposed). Construction of the maintenance yard may also result in such disruption, although disruptions at the previously studied Bayshore/Brisbane location would likely be minimal given the lack of active use at the site at present (this would change if the site or the environs are developed as proposed in the Brisbane Baylands project). Disruption will depend on the location. Construction of the passing tracks could have the most substantial temporary disruptions to roadways, pedestrian, and bike lanes that cross the Caltrain ROW.

Construction of other transportation projects could also result in disruptions to existing roadway, bicycle, pedestrian facilities as well as access depending on their routing and present transportation facilities. For other non-transportation cumulative projects, there is usually less potential for substantial disruption to transportation systems and facilities, except when existing facilities are proposed for temporary closure or rerouting during construction although temporary delays are always possible during delivery of large materials and construction of utility connections in local roadways.

As discussed in Section 3.14, *Transportation and Traffic,* with the Proposed Project, installation of the OCS poles and construction of the TPFs would not generally disrupt existing transportation systems or transit operations except in limited circumstances. However, construction at the at-grade crossings to install OCS infrastructure and to update grade crossing warning devices would result in temporary roadway closures (as well as bike and pedestrian crossings where present). Where OCS infrastructure needs to be installed near other transit systems, such as at the Millbrae Station shared by Caltrain and BART or in San Francisco at 16th Street where Muni plans to install Muni OCS infrastructure for the re-routing of the 22-Fillmore Trolley Bus[19], there is the potential for temporary disruption of other transit systems. There is also the potential to disrupt freight service operations during construction. Caltrain will coordinate with all affected transit operations to avoid and minimize the duration and extent of any potential disruption. With the implementation of mitigation measures identified in Section 3.14, *Transportation and Traffic*, the Proposed Project would minimize potential disruptions to transportation facilities and transit services. Thus, with mitigation, Proposed Project construction would make a less-than-considerable contribution to any potential cumulative impacts on transportation facilities and systems.

[19] See discussion below under Operations about proposed mitigation to allow simultaneous operations of the Caltrain 25 KVA AC OCS and the Muni 600 V DC OCS at the 16th Street crossing.

Emergency Vehicle Access

During cumulative project construction, there may be temporary obstruction of access and egress from construction sites and on adjacent roads due to construction. Such obstruction would affect the ability of emergency responders to timely reach their response destinations and/or impede the ability to evacuate constrained areas in the event of an emergency. Where one or more cumulative projects would be in construction at the same time in the same area, it is possible there could be cumulative impacts on emergency response or evacuation capacity.

As discussed in Section 3.8, *Hazards and Hazardous Materials*, the Proposed Project could have also have such effects if emergency occurs at the time when the Proposed Project construction may involve temporary access or egress limitations from the Caltrain ROW or at at-grade crossings along the Caltrain ROW (when changing grade-crossing warning devices). As described in Section 3.14, *Transportation and Traffic*, project mitigation measures will require the preparation of a traffic control plan to help ensure continued emergency access to Caltrain ROW, at-grade crossings, and all nearby properties. Caltrain will coordinate with local public works department, local emergency providers, and Caltrans in the development of the traffic control plan to specifically address emergency response concerns. Any potential issues associated with multiple projects in construction at the same time can be addressed through development of the traffic control plan. Thus, with mitigation, the Proposed Project's contribution to a potential cumulative impact related to emergency response or evacuation would be less than considerable).

Operation

Roadway Traffic Operations

Regional and City Vehicle Miles Traveled

As presented in Appendix I, Ridership Technical Memorandum, regional growth will result in a substantial increase in VMT even with the improvements in transit systems currently programmed for the future, including the Proposed Project. However, compared with No Project conditions, the Proposed Project will result in a substantial reduction in regional VMT of 235,000 miles per day in 2020. With full electrification and the Downtown Extension, the reduction in regional VMT in 2040 would be 619,000 miles per day as shown in Table 4-15. Thus, the Proposed Project would have a beneficial regional effect on vehicle traffic by providing such a substantial reduction in regional traffic.

Table 4-15. Average Regional Daily Vehicle Miles of Traveled

	Vehicle Miles of Traveled		
Scenario	Peak Hours	Off-Peak Hours	Daily Total
Existing Condition	96,260,000	82,401,000	178,660,000
2040 No Project	120,676,500	105,846,300	226,522,800
2040 Project	120,159,200	105,744,700	225,903,900

Table 4-16 displays daily VMT within each city in the project area for 2040 No Project and Project scenarios. City-level VMT is calculated by accounting for the total mileage of all vehicle trips that occur within each city's boundaries, which known as the "boundary method" calculation.

In 2040, daily VMT in nearly cities would also be lower under the 2040 Project scenario than 2040 No Project scenario. The only exception is the City of San Mateo which would experience a very small increase in VMT due to the Proposed Project, likely attributable to slight increases in automobile traffic coming to and from San Mateo, Hayward Park and Hillsdale Stations. Total daily VMT under the 2040 Project scenario is projected to decrease by an average of 0.7 percent in all cities along the corridor compared with the 2040 No Project scenario.

Table 4-16. Weekday Daily Regional Vehicle Miles Traveled Within Each City, 2040 Scenario

	2040 No Project			2040 Project		
City	Peak[a]	Off-Peak [b]	All	Peak[a]	Off-Peak [b]	All
San Francisco	4,676,000	3,931,000	8,607,000	4,625,000	3,919,000	8,544,000
Brisbane	492,000	464,000	956,000	486,000	460,000	946,000
South San Francisco	824,000	662,000	1,487,000	813,000	659,000	1,472,000
San Bruno	587,000	415,000	1,003,000	576,000	414,000	989,000
Millbrae	248,000	183,000	431,000	242,000	182,000	424,000
Burlingame	609,000	529,000	1,138,000	596,000	526,000	1,122,000
San Mateo	1,476,000	1,298,000	2,774,000	1,482,000	1,293,000	2,775,000
Belmont	185,000	126,000	311,000	182,000	125,000	307,000
San Carlos	383,000	315,000	698,000	377,000	314,000	690,000
Redwood City	866,000	779,000	1,645,000	853,000	776,000	1,630,000
Atherton	90,000	49,000	139,000	87,000	49,000	136,000
Menlo Park	716,000	660,000	1,376,000	705,000	658,000	1,362,000
Palo Alto	947,000	751,000	1,698,000	926,000	749,000	1,675,000
Mountain View	1,157,000	953,000	2,110,000	1,137,000	951,000	2,088,000
Sunnyvale	1,601,000	1,226,000	2,827,000	1,577,000	1,223,000	2,800,000
Santa Clara	1,545,000	928,000	2,473,000	1,526,000	927,000	2,454,000
San Jose	11,024,000	8,814,000	19,838,000	10,953,000	8,812,000	19,765,000
TOTAL	27,426,000	22,083,000	49,511,000	27,143,000	22,037,000	49,179,000

Source: Appendix D, *Transportation Analysis*.

[a] Peak travel is defined as travel occurring from 5:00 a.m. to 9:00 a.m. and from 3:00 p.m. to 7:00 p.m.

[b] Off-peak travel is defined as travel occurring from 9:00 a.m. to 3:00 p.m. and from 7:00 p.m. to 5:00 a.m.

While certain locations on the Caltrain corridor may experience increases in traffic due to more automobiles driving to and from stations, the total effect is that total vehicle miles in all cities other than San Mateo would decrease due to the Proposed Project.

Intersection level of Service - 2040

As discussed in Section 3.14, *Transportation and Traffic*, the Proposed Project would result in an adverse effect at some localized intersections near at-grade crossings and Caltrain stations. The cumulative effect of growth in the area combined with cumulative transportation improvements included in the ridership model (see Appendix I), and the Proposed Project on traffic near at-grade crossings and Caltrain stations was evaluated using traffic modeling (see Appendix D). As shown in Table 4-17, compared with existing conditions, there are 39 study locations (out of ~~82~~ 91 total study locations) where there will be significant cumulative increase in local traffic delays.

Table 4-17. Intersection Delay and Levels of Service, 2040 Cumulative Conditions with and Without the Project Alternatives

Changes since the Draft EIR are shown in italics given that underlining is used as part of the significance indication.

Int. ID	Intersection	Jurisdiction	Peak Hour	Intersection Control	2040 No Project Delay	2040 No Project LOS	2040 Project Delay	2040 Project LOS	Change In Delay
	ZONE 1								
1	4th Street & King Street	SF	AM	Signal	**>120**	**F**	**>120**	**F**	**36.7**
			PM		**>120**	**F**	**>120**	**F**	-10.3
2	4th Street & Townsend Street	SF	AM	Signal	**>120**	**F**	**>120**	**F**	-20.3
			PM		**>120**	**F**	**>120**	**F**	-0.3
3	Mission Bay Drive & 7th Street	SF	AM	Signal	12.5	B	16.6	B	4.1
			PM		16.2	B	17.0	B	0.8
4	Mission Bay Drive & Berry Street	SF	AM	Signal	3.7	A	2.1	A	-1.6
			PM		8.8	A	8.6	A	-0.2
5	7th Street & 16th Street	SF	AM	Signal	**>120**	**F**	**>120**	**F**	**14.2**
			PM		**119.9**	**F**	**>120**	**F**	**14.4**
6	16th Street & Owens Street	SF	AM	Signal	11.3	B	10.6	B	-0.7
			PM		40.2	D	**55.8**	**E**	**15.6**
7	22nd Street & Pennsylvania Street	SF	AM	All-way Stop	13.5	B	14.2	B	0.7
			PM		9.6	A	11.2	B	1.6
8	22nd Street & Indiana Street	SF	AM	All-way Stop	7.4	A	7.1	A	-0.3
			PM		6.4	A	6.4	A	0.0
9	Tunnel Avenue & Blanken Avenue	SF	AM	All-way Stop	**>120**	**F**	**>120**	**F**	**>60**
			PM		**>120**	**F**	**>120**	**F**	**>60**
10	Linden Avenue & Dollar Avenue	SSF	AM	Signal	**81.8**	**F**	**>120**	**F**	**>60**
			PM		41.6	D	46.1	D	4.5
11	East Gr & Avenue & Dubuque Way	SSF	AM	Signal	12.4	B	13.2	B	0.8
			PM		13.8	B	15.1	B	1.3
12	S Linden Avenue & San Mateo Avenue	SSF	AM	Signal	27.9	C	**74.9**	**E**	**47.0**
			PM		10.6	B	13.4	B	2.8
13	Scott Street & Herman Street	SB	AM	Side-Street Stop	26.3	D	**45.9**	**E**	19.6[a]
			PM		18.2	C	18.4	C	0.2
14	Scott Street & Montgomery Avenue	SB	AM	Side-Street Stop	7.2	A	8.8	A	1.6
			PM		7.1	A	6.8	A	-0.3
15	San Mateo Avenue & San Bruno Avenue	SB	AM	Signal	33.3	C	40.7	D	7.4
			PM		24.6	C	32.5	C	7.9

Int. ID	Intersection	Jurisdiction	Peak Hour	Intersection Control	2040 No Project Delay	2040 No Project LOS	2040 Project Delay	2040 Project LOS	Change In Delay
	ZONE 2								
16	El Camino Real & Millbrae Avenue	MB	AM	Signal	**112.0**	**F**	**>120**	**F**	**11.1**
			PM		**68.5**	**E**	**84.7**	**F**	**16.2**
17	Millbrae Avenue & Rollins Road	MB	AM	Signal	**74.9**	**E**	**84.4**	**F**	**9.5**
			PM		**110.2**	**F**	**>120**	**F**	**29.3**
18	California Drive & Broadway	BG	AM	Signal	***154.1***	***F***	***138.5***	***F***	*-15.6*
			PM		***170.3***	***F***	***160.4***	***F***	*-9.9*
19	Carolan Avenue & Broadway	BG	AM	Signal	***101.5***	***F***	***112.5***	***F***	***11.0***
			PM		***92.4***	***F***	***97.4***	***F***	***5.0***
20	California Drive & Oak Grove Avenue	BG	AM	Signal	**>120**	**F**	**91.2**	**F**	-34.1
			PM		**76.9**	**E**	**99.1**	**F**	**22.2**
21	Carolan Avenue & Oak Grove Avenue	BG	AM	Side-Street Stop	**>120**	**F**	**>120**	**F**	**>60**
			PM		**>120**	**F**	**>120**	**F**	**>60**
22	California Drive & North Lane	BG	AM	Side-Street Stop	28.4	D	20.4	C	-8.0
			PM		18.4	C	21.4	C	3.0
23	Carolan Avenue & North Lane	BG	AM	Side-Street Stop	**>120**	**F**	**>120**	**F**	>-60
			PM		43.7	E	**69.4**	**F**	25.7[a]
24	Anita Road & Peninsula Avenue	BG	AM	Side-Street Stop	29.1	D	31.9	D	28
			PM		**67.6**	**F**	**36.1**	**E**	-31.5
83	*Broadway and Rollins Road*	*BG*	*AM*	*Signal*	***61.0***	***E***	***64.5***	***E***	*3.5*
			PM		***57.5***	***F***	***58.9***	***F***	*1.4*
84	*Rollins Road and Cadillac Way*	*BG*	*AM*	*Signal*	*9.0*	*A*	*11.3*	*B*	*2.3*
			PM		*10.8*	*A*	*8.0*	*A*	*-2.8*
84a	*Broadway and US 101 Southbound Ramps*	*BG*	*AM*	*Signal*	***85.5***	***F***	***88.1***	***F***	*2.6*
			PM		*48.8*	*D*	*51.1*	*D*	*2.3*
85	*Bayswater Avenue and California Drive*	*BG*	*AM*	*Signal*	*44.7*	*D*	*26.7*	*C*	*-18.0*
			PM		*20.3*	*C*	*23.1*	*C*	*2.8*
25	Woodside Way & Villa Terrace	SM	AM	Side-Street Stop	5.1	A	5.0	A	-0.1
			PM		5.5	A	5.3	A	-0.2
26	North San Mateo Drive & Villa Terrace	SM	AM	Side-Street Stop	12.2	B	11.8	B	-0.4
			PM		17.2	C	10.2	B	-7.0
27	Railroad Avenue & 1st Avenue	SM	AM	Side-Street Stop	**>120**	**F**	15.0	B	>-60
			PM		**>120**	**F**	**>120**	**F**	>-60
28	S B Street & 1st Avenue	SM	AM	Signal	48.4	D	20.7	C	-27.7
			PM		**66.9**	**F**	**>120**	**F**	**193.2**
29	9th Avenue & S Railroad Avenue	SM	AM	Side-Street Stop	**>120**	**F**	**>120**	**F**	**>60**
			PM		**>120**	**F**	**91.6**	**F**	-37.7
30	S B Street & 9th Avenue	SM	AM	Signal	34.3	C	**67.7**	**E**	**33.4**
			PM		51.5	D	**69.3**	**E**	**17.8**
31	Transit Center Way & 1st Avenue	SM	AM	Uncontrolled	**49.0**	**F**	9.2	A	-39.8
			PM		**88.2**	**F**	**69.3**	**F**	-18.9

Int. ID	Intersection	Jurisdiction	Peak Hour	Intersection Control	2040 No Project Delay	2040 No Project LOS	2040 Project Delay	2040 Project LOS	Change In Delay
32	Concar Drive & SR 92 Westbound Ramps	SM	AM	Signal	20.8	C	35.3	D	14.5
			PM		13.4	B	12.3	B	-1.1
33	S Delaware Street & E 25th Avenue	SM	AM	Signal	**55.7**	**E**	25.6	C	-30.1
			PM		**>120**	**F**	**>120**	**F**	-5.3
34	E 25th Avenue & El Camino Real	SM	AM	Signal	**84.4**	**F**	**63.4**	**E**	-21.0
			PM		**>120**	**F**	**>120**	**F**	-0.3
35	31st Avenue & El Camino Real	SM	AM	Signal	**77.7**	**E**	32.6	C	-45.1
			PM		**117.7**	**F**	**>120**	**F**	**19.0**
36	E Hillsdale Boulevard & El Camino Real	SM	AM	Signal	***>120***	**F**	45.6	D	*>-60*
			PM		***92.0***	**F**	**>120**	**F**	**>60**
37	E Hillsdale Blvd. & Curtiss Street	SM	AM	Signal	**55.6**	**E**	22.5	C	-33.1
			PM		**66.7**	**E**	**>120**	**F**	**48.5**
38	Peninsula Avenue & Arundel Road & Woodside Way	SM	AM	Side-Street Stop	22.0	C	24.3	C	2.3
			PM		47.4	E	30.2	D	-17.2
39	El Camino Real & Ralston Avenue	BL	AM	Signal	**>120**	**F**	**>120**	**F**	**41.4**
			PM		**>120**	**F**	**>120**	**F**	0.2
40	El Camino Real & San Carlos Avenue	SC	AM	Signal	20.0	B	24.5	C	4.5
			PM		46.1	D	46.9	D	0.8
41	Maple Street & Main Street[b]	RC	AM	Side-Street Stop	42.7	E	22.2	C	-20.5
			PM		>120	F	>120	F	>60
42	Main Street & Beech Street	RC	AM	Side-Street Stop	19.7	C	15.0	B	4.7
			PM		**>120**	**F**	**>120**	**F**	>-60.0
43	Main Street & Middlefield Road[b]	RC	AM	Signal	30.3	C	>120	F	>60.0
			PM		>120	F	>120	F	-1.6
44	Broadway Street & California Street[b]	RC	AM	Side-Street Stop	>120	F	>120	F	>-60.0
			PM		>120	F	>120	F	>-60.0
45	El Camino Real & Whipple Avenue	RC	AM	Signal	**71.7**	**E**	**109.2**	**F**	**37.5**
			PM		**85.0**	**F**	**88.3**	**F**	3.3
46	Arguello Street & Brewster Avenue[b]	RC	AM	Signal	>120	F	83.4	F	>-60.0
			PM		115.9	F	112.1	F	-3.8
47	El Camino Real & Broadway Street[b]	RC	AM	Signal	>120	F	>120	F	-41
			PM		>120	F	>120	F	1.3
48	Arguello Street & Marshall Street[b]	RC	AM	Signal	>120	F	>120	F	>-60.0
			PM		>120	F	>120	F	14.1
49	El Camino Real & James Avenue[b]	RC	AM	Signal	>120	F	>120	F	-22.8
			PM		>120	F	>120	F	4.6
	ZONE 3								
50	El Camino Real & Fair Oaks Lane	AT	AM	Signal	**>120**	**F**	**>120**	**F**	**46.1**
			PM		**104.2**	**F**	**103.5**	**F**	-0.7

Int. ID	Intersection	Jurisdiction	Peak Hour	Intersection Control	2040 No Project Delay	2040 No Project LOS	2040 Project Delay	2040 Project LOS	Change In Delay
51	El Camino Real & Watkins Avenue	AT	AM	Side-street stop	**>120**	**F**	**>120**	**F**	>-60.0
			PM		**>120**	**F**	**>120**	**F**	>-60.0
52	Fair Oaks Lane & Middlefield Road	AT	AM	Side-Street Stop	**>120**	**F**	**>120**	**F**	**>60.0**
			PM		**>120**	**F**	**>120**	**F**	>-60.0
53	Watkins Avenue & Middlefield Road	AT	AM	Side-Street Stop	**75.4**	**F**	**>120**	**F**	***>60.0***
			PM		**>120**	**F**	**>120**	**F**	>-60.0
54	Glenwood Avenue & Middlefield Road	AT	AM	Side-Street Stop	**>120**	**F**	**>120**	**F**	>-60.0
			PM		**>120**	**F**	**>120**	**F**	>-60.0
87	*Encinal Avenue and Middlefield Road*	*AT*	*AM*	*Signal*	*26.4*	*C*	*33.5*	*C*	*7.1*
			PM		*20.5*	*C*	*19.0*	*B*	*-1.5*
86	*Encinal Avenue and El Camino Real*	*MP*	*AM*	*Signal*	*29.9*	*C*	*39.8*	*D*	*9.9*
			PM		***96.0***	***F***	***56.2***	***E***	*-39.8*
55	El Camino Real & Glenwood Avenue	MP	AM	Signal	**93.9**	**F**	**>120**	**F**	**>60**
			PM		**>120**	**F**	**>120**	**F**	>-60
56	El Camino Real & Oak Grove Avenue	MP	AM	Signal	**81.3**	**F**	**96.9**	**F**	**15.6**
			PM		**94.6**	**F**	**84.0**	**F**	-10.6
57	El Camino Real & Santa Cruz Avenue	MP	AM	Signal	46.9	D	37.7	D	-9.2
			PM		**78.4**	**E**	**>120**	**F**	**>60**
58	Merrill St & Santa Cruz Avenue	MP	AM	All-way Stop	14.5	B	9.8	A	-4.7
			PM		**>120**	**F**	**>120**	**F**	**45.9**
59	Ravenswood Avenue & Alma Street	MP	AM	Side-Street Stop	**75.8**	**F**	**66.4**	**F**	-9.4
			PM		**84.2**	**F**	**>120**	**F**	>-60
60	El Camino Real & Ravenswood Avenue	MP	AM	Signal	**120.1**	**F**	**99.1**	**F**	-21.0
			PM		**>120**	**F**	**>120**	**F**	-4.9
61	Ravenswood Avenue & Laurel Street	MP	AM	Signal	**89.2**	**F**	**83.4**	**F**	-5.8
			PM		**>120**	**F**	**>120**	**F**	>-60
88	*Laurel Street and Oak Grove Avenue*	*MP*	*AM*	*Signal*	*11.2*	*B*	*33.8*	*C*	*22.6*
			PM		*33.5*	*C*	*18.3*	*B*	*-15.2*
89	*Laurel Street and Glenwood Avenue*	*MP*	*AM*	*All-way Stop*	*11.2*	*B*	*13.7*	*B*	*2.5*
			PM		***37.9***	***E***	*13.4*	*B*	*-24.5*
90	*Laurel Street and Encinal Avenue*	*MP*	*AM*	*All-way Stop*	*6.8*	*A*	*9.3*	*A*	*2.5*
			PM		*6.4*	*A*	*5.9*	*A*	*-0.5*
62	Alma Street & Palo Alto Avenue	PA	AM	Side-Street Stop	39.5	E	21.9	C	-17.6
			PM		24.3	C	28.5	D	4.2
63	Meadow Drive & Alma Street	PA	AM	Signal	**>120**	**F**	**>120**	**F**	**43.3**
			PM		**>120**	**F**	**>120**	**F**	**8.5**
64	El Camino Real & Alma & Sand Hill Road	PA	AM	Signal	**62.1**	**E**	**85.8**	**F**	**23.7**
			PM		**>120**	**F**	**>120**	**F**	**28.0**
65	High Street & University Avenue	PA	AM	Signal	10.1	B	13.6	B	3.5
			PM		24.5	C	24.5	C	0
66	Alma Street & Churchill Avenue	PA	AM	Signal	**>120**	**F**	**>120**	**F**	**10.5**
			PM		**>120**	**F**	**>120**	**F**	-0.7

Int. ID	Intersection	Jurisdiction	Peak Hour	Intersection Control	2040 No Project Delay	2040 No Project LOS	2040 Project Delay	2040 Project LOS	Change In Delay
67	W Meadow Drive & Park Blvd.	PA	AM	Side-Street Stop	**>120**	**F**	**>120**	**F**	≥60[a]
			PM		**>120**	**F**	**>120**	**F**	22.6[a]
68	Alma Street & Charleston Road	PA	AM	Signal	**>120**	**F**	**>120**	**F**	**>60**
			PM		**>120**	**F**	**>120**	**F**	-30.4
69	Showers Drive & Pacchetti Way	MV	AM	Signal	5.2	A	5.2	A	0.0
			PM		4.9	A	6.4	A	1.5
70	Central Expressway & N Rengstorff Avenue	MV	AM	Signal	**>120**	**F**	**>120**	**F**	***7.7***
			PM		**>120**	**F**	**>120**	**F**	*-6.2*
71	Central Expressway & Moffett Boulevard & Castro Street	MV	AM	Signal	**>120**	**F**	**>120**	**F**	*-3.1*
			PM		**>120**	**F**	**>120**	**F**	**>60**
72	W Evelyn Avenue & Hope Street	MV	AM	Signal	2.8	A	2.6	A	-0.2
			PM		4.7	A	4.9	A	0.2
73	Rengstorff Avenue & California Street	MV	AM	Signal	**168.5**	**F**	**196.8**	**F**	**28.3**
			PM		**175.7**	**F**	**263.2**	**F**	**>60**
74	Castro Street & Villa Street	MV	AM	Signal	41.6	D	**71.4**	**E**	**29.8**
			PM		**112.5**	**F**	**116.8**	**F**	**4.3**
75	W Evelyn Avenue & S Mary Avenue	SV	AM	Signal	**92.1**	**F**	**110.2**	**F**	**18.8**
			PM		**88.8**	**F**	**96.8**	**F**	**8.0**
76	W Evelyn Avenue & Frances Street	SV	AM	Signal	47.5	D	**287.9**	**F**	**>60**
			PM		51.7	D	**98.1**	**F**	**46.4**
	ZONE 4								
77	Kifer Road & Lawrence Expressway[c]	SCL	AM	Signal	>120	F	**>120**	**F**	**55.4**
			PM		>120	F	>120	F	-47.4
78	Reed Avenue & Lawrence Expressway	SCL	AM	Signal	**>120**	**F**	**>120**	**F**	**9.1**
			PM		**>120**	**F**	**>120**	**F**	>-60
79	El Camino Real & Railroad Avenue	SCL	AM	Signal	20.4	C	**69.5**	**E**	**49.1**
			PM		35.5	D	39.2	D	3.7
80	W Santa Clara Street & Cahill Street	SJ	AM	Signal	***89.4***	**F**	**84.5**	**F**	*-4.9*
			PM		**92.2**	**F**	54.7	D	-37.5
81	S Montgomery Street and W San Fernando Street	SJ	AM	Signal	*31.3*	C	51.6	D	*20.3*
			PM		**>120**	**F**	**86.3**	**F**	>-60
82	Lick Avenue and W Alma Avenue	SJ	AM	Signal	24.6	C	**62.1**	**E**	**37.5**
			PM		**65.5**	**E**	**63.0**	**E**	-2.5

Int. ID	Intersection	Jurisdiction	Peak Hour	Intersection Control	2040 No Project Delay	2040 No Project LOS	2040 Project Delay	2040 Project LOS	Change In Delay
Source: Appendix D, *Transportation Analysis*									
Jurisdictions:									
SF	San Francisco	SM	San Mateo				MV	Mountain View	
SSF	South San Francisco	BL	Belmont				SV	Sunnyvale	
SB	San Bruno	SC	San Carlos				SCL	Santa Clara	
MB	Millbrae	RC	Redwood City				SCC	Santa Clara	
BG	Burlingame	AT	Atherton				County		
MP	Menlo Park	PA	Palo Alto				SJ	San Jose	

AM = morning peak hour, PM = afternoon peak hour
LOS designation as per 2010 Highway Capacity Manual
Delay measured in seconds
Bold font represents an LOS that is below the established threshold of significance as per the Significance Criteria compared with existing conditions.
Bold Underline font represents locations and conditions where the Proposed Project would result in a significant impact relative to the No Project conditions

[a] Although the Proposed Project would increase delay at LOS F conditions, the intersection would not meet a signal warrant and thus per the significance criteria would not have a significant impact.

[b] Downtown Redwood City has no level of service standard for intersections in the *Downtown Precise Plan* area (Policy BE-29.4).

[c] City of Santa Clara level of service exemptions exist for new development, to facilitate alternate transportation in Station Focus Areas.

The results in Table 4-17 do not include the localized effects of increased HSR ridership at HSR stations for 2040 or the effects of potential increases in gate down time on intersections near at-grade crossings due to Blended Service and other non-project increases in passenger and freight rail traffic indicated in Table 4-8 above. As discussed in Appendix D, the effect of increased rail service on gate-down time is highly site specific and is dependent on very specific assumptions about train schedules. Given the current level of planning for Blended Service, any assumptions about schedule and service would be speculative. Similarly, there are no published schedule analyses or draft environmental documents for other service improvement plans, such as for ACE, Capitol Corridor, Amtrak, and DRC or freight increases, and it would also be speculative to make assumptions about their schedules at this time as well. Nevertheless, given the substantial service increases shown in Table 4-8, it would be reasonable to assume that the impacts around HSR stations and at at-grade crossings shown in Table 4-17 may underestimate the potential cumulative traffic delays, perhaps substantially.

Based on the impact criteria from Section 3.14, *Transportation and Traffic*, in 2040 the Proposed Project will have a significant impact at 39 study intersections during the AM and/or PM peak hours compared with the 2040 No Project conditions as shown in Table 4-17. Mitigation options were evaluated for all of these intersections. The following criteria were used to determine if the identified mitigation option would reduce the Proposed Project's impact to a less-than-significant level.

- If the intersection operates at LOS A–D under the No Project conditions, the mitigation measures must allow the intersection to continue operating at LOS A–D under the project alternative.

- If the intersection operates at LOS E or F under the No Project conditions, the mitigation measures must ensure that the delay under the project alternative does not increase by 4 seconds or more.

Mitigation Measure TRA-CUMUL-1 below provides feasible mitigation measures for a number of these intersections. Of the 39 intersections noted as significantly affected, as shown in Table 4-18, 17 would have significant and unavoidable impacts under 2040 Project conditions either because, there is no feasible mitigation available to reduce the impact to a less-than-significant level or because the identified mitigation is insufficient to reduce the impact to a less-than-significant level.

Table 4-18. Summary of 2040 Cumulative Intersection Impacts and Mitigation Measures

Int. ID	Intersection	Impacted Peak Hour(s)	Mitigation Strategies	Impact Significance after Mitigation
Signalized Intersections				
1	4th Street and King Street	AM	Adjust signal timings to better serve traffic after project implementation	Significant and unavoidable (SU)
5	7th Street and 16th Street	AM and PM	Widen northbound approach to lengthen left turn pocket Revise signal timing and phasing to better coordinate with 16th Street and Owens Street. Pre-emption, pre-signals or queue cutters to prevent an increase in potential queue back to the grade crossing.	Less-than-significant after mitigation (LTS)
6	16th Street and Owens Street	PM	Revise signal timing and phasing to better coordinate with 7th Street and 16th Street	Less-than-significant after mitigation (LTS)
10	Linden Avenue and Dollar Avenue	AM	Adjust signal timing to better serve traffic after project implementation	Less-than-significant after mitigation (LTS)
12	S Linden Avenue and San Mateo Avenue	AM	Adjust signal timing to better serve traffic after project implementation	Less-than-significant after mitigation (LTS)
16	El Camino Real and Millbrae Avenue	AM and PM	Adjust signal timing to better serve traffic after project implementation	Less-than-significant after mitigation (LTS) in AM Significant and unavoidable (SU) in PM
17	Millbrae Avenue and Rollins Road	AM and PM	Adjust signal timing to better serve traffic after project implementation	Less-than-significant after mitigation (LTS)
19	Carolan Avenue and Broadway	AM and PM	Include northbound right-turn overlap. Adjust signal timing to better serve traffic after project implementation	Less-than-significant after mitigation (LTS)
20	California Drive and Oak Grove Avenue	PM	Adjust signal timing to better serve traffic after project implementation	Less-than-significant after mitigation (LTS)
28	S B Street and 1st Avenue	PM	Adjust signal timing to better serve traffic after project implementation	Less-than-significant after mitigation (LTS)

Int. ID	Intersection	Impacted Peak Hour(s)	Mitigation Strategies	Impact Significance after Mitigation
30	S B Street and 9th Avenue	AM and PM	Extend southbound left-turn pocket Remove parking to add eastbound left-turn pocket Adjust signal timing to better serve traffic after project implementation Pre-emption, pre-signals or queue cutters to prevent an increase in potential queue back to the grade crossing.	Less-than-significant after mitigation (LTS) in AM Significant and unavoidable[a] (SU) in PM
35	31st Avenue and El Camino Real	PM	Adjust signal timing to better serve traffic after project implementation	Less-than-significant after mitigation (LTS)
36	E Hillsdale Boulevard and El Camino Real	PM	Reconfigure westbound to two through lanes and one shared through/right-turn lane Adjust signal timing to better serve traffic after project implementation	Less-than-significant after mitigation (LTS)
37	E Hillsdale Boulevard and Curtiss Street	PM	Adjust signal timing to better serve traffic after project implementation	Less-than-significant after mitigation (LTS)
39	El Camino Real and Ralston Avenue	AM	Restripe westbound shared through/left-turn lane into a through lane Revise signal timing and phasing to better serve traffic after project implementation	Less-than-significant after mitigation (LTS)
45	El Camino Real and Whipple Avenue	AM	Adjust signal timing to better serve traffic after project implementation	Significant and unavoidable (SU)
50	El Camino Real and Fair Oaks Lane	AM	Adjust signal timing to better serve traffic after project implementation	Less-than-significant after mitigation (LTS)
55	El Camino Real and Glenwood Avenue	AM	Widen westbound approach to provide right-turn pocket Adjust signal timing to better serve traffic after project implementation	Significant and unavoidable (SU)
56	El Camino Real and Oak Grove Avenue	AM	Adjust signal timing to better serve traffic after project implementation	Less-than-significant after mitigation (LTS)
57	El Camino Real and Santa Cruz Avenue	PM	Adjust signal timing to better serve traffic after project implementation	Less-than-significant after mitigation (LTS)
63	Meadow Drive and Alma Street	AM and PM	No feasible mitigations exist[b]	Significant and unavoidable (SU)
64	El Camino Real and Alma Street and Sand Hill Road	AM and PM	Widen west leg of Sand Hill Road by adding one lane to allow southbound right turns on red Adjust signal timings to better serve traffic after project implementation	Significant and unavoidable (SU) in AM Less-than-significant after mitigation (LTS) in PM
66	Alma Street and Churchill Avenue	AM	No feasible mitigations exist[b]	Significant and unavoidable (SU)

Int. ID	Intersection	Impacted Peak Hour(s)	Mitigation Strategies	Impact Significance after Mitigation
68	Alma Street and Charleston Road	AM	No feasible mitigations exist[b]	Significant and unavoidable (SU)
70	Central Expressway and N Rengstorff Avenue	AM	No feasible mitigations exist[b]	Significant and unavoidable (SU)
71	Central Expressway and Moffett Boulevard and Castro Street	AM and PM	No feasible mitigations exist[b]	Significant and unavoidable (SU)
73	Rengstorff Avenue and California Street	AM and PM	Revise signal timing and phasing to better serve traffic after project implementation	Significant and unavoidable (SU)
74	Castro Street and Villa Street	AM and PM	Remove five on-street parking spaces on the eastbound approach to add a left turn pocket ~~Remove parking to stripe one left-turn pocket and one through lane for the eastbound and westbound directions~~ Revise signal timing and phasing to better serve traffic after project implementation	Less-than-significant after mitigation (LTS)
75	W Evelyn Avenue and S Mary Avenue	AM and PM	No feasible mitigations exist[c]	Significant and unavoidable (SU)
76	W Evelyn Avenue and Frances Street	AM and PM	Stripe westbound as one through lane and one shared through/right-turn lane Revise signal timing and phasing to better serve traffic after project implementation	Significant and unavoidable (SU)
77	Kifer Road and Lawrence Expressway	AM	No feasible mitigations exist[d]	Significant and unavoidable (SU)
78	Reed Avenue and Lawrence Expressway	AM	No feasible mitigations exist[d]	Significant and unavoidable (SU)
79	El Camino Real and Railroad Avenue	AM	Revise signal timing and phasing to better serve traffic after project implementation	Less-than-significant after mitigation (LTS)
82	Lick Avenue and W Alma Avenue	AM	Revise signal timing and phasing to better serve traffic after project implementation	Less-than-significant after mitigation (LTS)
Unsignalized Intersections				
9	Tunnel Avenue and Blanken Avenue	AM and PM	Signalize intersection	Less-than-significant after mitigation (LTS)
21	Carolan Avenue and Oak Grove Avenue	AM and PM	Signalize intersection with the addition of northbound and westbound left-turn pockets	Significant and unavoidable[e] (SU) in AM Less-than-significant after mitigation (LTS) in PM

Int. ID	Intersection	Impacted Peak Hour(s)	Mitigation Strategies	Impact Significance after Mitigation
52	Fair Oaks Lane and Middlefield Road	AM	Signalize intersection	Less-than-significant after mitigation (LTS)
53	Watkins Avenue and Middlefield Road	AM and PM	Signalize intersection	Less-than-significant after mitigation (LTS)
58	Merrill Street and Santa Cruz Avenue	PM	Signalize intersection	Less-than-significant after mitigation (LTS)

Source: Appendix D, *Transportation Analysis*

[a] Less-than-significant after mitigation but a secondary impact is produced at Intersection #29 (9th Avenue and S Railroad Avenue). After mitigation, the delay increases by more than four seconds at Intersection #29.

[b] Addition of through lanes along Central Expressway and Alma Street may reduce the impact, but the addition of through lanes is subject to right-of-way constraints and is therefore infeasible.

[c] Implementation of a grade separated crossing may reduce the impact but is subject to fiscal and temporal constraints. Therefore this mitigation is considered infeasible for purposes of this document.

[d] Grade separated interchanges are under study but have yet to be approved or funded.

[e] Less-than-significant after mitigation but a secondary impact is produced at Intersection #20 (California Drive and Oak Grove Avenue). After mitigation, the delay increases by more than four seconds at Intersection #20.

While the Proposed Project would have an adverse contribution to cumulative traffic delays at certain locations, the Proposed Project is only a small overall contributor compared with the effects of general growth along the Peninsula. This is shown by the 2040 No Project conditions which in many cases indicate a substantial decline in traffic level of service from 2013 conditions with a lesser contribution to delays above the 2040 No Project conditions shown by the 2040 Project conditions. Further as noted above, the net effect of the Proposed Project is to reduce regional daily VMT which produces benefits at many intersections, roadways, and freeways away from the at-grade crossings and Caltrain stations.

Thus, any mitigation to address overall cumulative traffic impacts is the responsibility of all cumulative contributors to the future conditions, including local jurisdictions, future development, as well as other rail services that plan increases in the Caltrain corridor, in addition to Caltrain.

As described in Mitigation Measure TRA-CUMUL-1, Caltrain will work with local jurisdictions, transportation funding agencies, and state and federal agencies to support traffic improvements over time as funding becomes available. While the recommended mitigation below, where feasible to implement, would help to reduce cumulative traffic impacts, it will take time to implement it, is funding limited and may only be partially implementable in the future, and it may not be feasible to reduce all cumulative traffic impacts to a less than significant level, thus the Proposed Project is considered to make a ~~fair-share~~ considerable contribution to significant cumulative traffic impacts, even with mitigation. Caltrain will fund and implement the signal and minor roadway measures proposed in Table 4-17. Other longer-term improvements will have to be implemented in concert with local, regional, state, and federal partners as funding becomes available.

As to secondary environmental impacts of Mitigation Measure TRA-CUMUL-1, the environmental effects of the minor roadway improvements such as traffic signal optimization and roadway

geometry changes would likely be limited in scale and nature. Caltrain will work with other parties when implementing this measure to apply the relevant construction mitigation measures identified in this EIR to these minor improvements.

As to roadway major widenings or grade separations, the design and feasibility of such potential future mitigations are unknown and unstudied at this time, and, thus, the specific environmental impacts cannot be identified. Such major improvements will need to have their own environmental review as appropriate[20], as they can have substantial environmental impacts depending on their design and location and their construction can be highly disruptive and, thus, as a conservative assumption, their secondary environmental impacts are considered significant and unavoidable.

Mitigation Measure TRA-CUMUL-1: Implement a phased program to provide traffic improvements to reduce traffic delays near at-grade crossings and Caltrain stations

The proposed signalization and minor roadway mitigations in Table 4-18 will be fully funded by Caltrain as they are directly related to the Proposed Project impact compared to 2040 No Project conditions. The performance standard for the project impacts compared to the No Project conditions are the significance criteria used in this EIR.

Other long-term mitigation, such as grade separations, cannot be committed to by Caltrain at this time due to funding limitations, but Caltrain will work with local jurisdictions and funding partners to support such improvements as funding becomes available. JPB will coordinate with local jurisdictions during the design phase of roadway mitigation measures that affect roadways under local jurisdiction.

Caltrain, in cooperation with local agencies and other parties, will support a phased program seeking to improve local roadway conditions along the Caltrain corridor near at-grade crossings and Caltrain stations where cumulative impacts have been identified and where the Proposed Project makes an adverse contribution to traffic delays. Separate from the specific Table 4-18 mitigation, given that there are multiple contributors to cumulative traffic conditions, Caltrain is only responsible to fund its fair share for other necessary improvements with local jurisdictions, future land use development as well as other rail services responsible to fund their fair share as well. Fair share shall be determined by cumulative contributions to future traffic levels or delays at identified significant cumulatively affected intersections and roadways determined using traffic modelling.

In the long run, where adequate funding is available, there are a variety of technically feasible The following traffic improvements that would help to reduce cumulative traffic delays at intersections near at-grade crossings and Caltrain stations including, but not limited to the following options:

- Traffic signal optimization: Signal timing optimization ~~can be performed to reduce delay at grade crossings. This~~ can include optimizing the cycle time, splits, and phasing. In addition, for closely spaced intersections, optimizing the offset and better signal coordination can also reduce delay. Signal optimization ~~was considered~~ is proposed as a mitigation measure at a number of study intersections as shown in Table 4-18 ~~Table 4-17~~. Caltrain will fund and implement the signalization in Table 4-18 as these impacts are directly related to Proposed Project impacts as they are identified relative to 2040 No Project conditions.

[20] As noted above, grade separations are statutorily exempt from CEQA.

- Roadway Geometry Changes: Changing the roadway geometry can also help reduce intersection delay. This can include changing the roadway width by widening the street or changing the existing geometry configuration through restriping. Intersection #43 (Main Street and Middlefield Road) and Intersection #64 (El Camino Real and Alma Street and Sand Hill Road) are examples of where roadway geometry could be altered as a mitigation measure to reduce intersection delay. ~~More detailed information can be found~~ Roadway changes are proposed in Table 4-18 ~~Table 4-17~~. Caltrain will fund and implement the roadway improvements in Table 4-18 as these impacts are directly related to Proposed Project impacts as they are identified relative to 2040 No Project conditions.
- Grade Separations: Given the costs and disruption of major roadway widenings and grade separations[21], Caltrain cannot commit at this time to a comprehensive program of improvements that would address all cumulative impacts in the future, because it does not have the identified funding and does not expect to receive sufficient funding in the foreseeable future. However, Caltrain, in cooperation with local jurisdictions, transportation funding agencies, and state and federal agencies, will support incremental grade separations at locations of cumulative traffic impacts over time as funding becomes available. Caltrain will work with local, state, and federal partners to establish priorities for roadway improvements grade separations to be implemented as funding becomes available. Caltrain will also work with other rail parties to seek funding participation from multiple parties on a fair-share basis in proportion to traffic contributions or project contributions to traffic delays.
- Road Closures: One option for managing local traffic is to close roadways at grade crossings and reroute traffic via alternative roadways. This option may not be feasible or acceptable to local jurisdictions at many, if not all locations.

This mitigation is funding limited as it relates to major road widenings and grade separations and will likely take many decades to implement. As noted above, the JPB is committed to implementing the improvements shown in Table 4-18 in a phased program as needed to address the Proposed Project's effects on local traffic.

Transit Services

As described in Section 3.14, *Transportation and Traffic*, the Proposed Project would not conflict or create inconsistences with adopted transit plans, guidelines, policies or standards adopted by project area cities, counties, the MTC, or the State of California. The Proposed Project has a beneficial effect on transit plans as it implements a long-planned for increase in Caltrain service and modernization. Table 4-19 shows the modelled ridership for the Caltrain system in 2040 (from Appendix D). Table 4-20 shows the modelled ridership for connecting transit systems in 2040 (from Appendix I).

[21] While grade separations are a technically feasible way to reduce cumulative traffic impacts at the at-grade locations, it is a highly expensive mitigation strategy. As discussed above, Caltrain supports future efforts at grade separation where acceptable to local communities and where local, state, and federal funding can be obtained to fund these improvements. However, using an average assumed cost of $50 to $100 million per crossing (grade separations can cost much more sometimes), grade separating all existing 42 at-grade crossings would cost $2.1 to $4.2 billion. Grade separating only 17 locations that are nearest the 17 significant unavoidably impacted intersections noted above could cost $850 million to $1.7 billion. The budget for the Proposed Project is $1.225 billion by comparison. Thus, Caltrain cannot commit to a comprehensive program of grade separations at this time.

The amount of Caltrain ridership to the Transbay Transit Center will depend on the amount of Caltrain service to the TTC. The system-wide ridership model evaluation (Appendix I) was conducted assuming that two trains per peak hour per direction would go to the TTC. This assumption of two trains is based on the operational studies to date by Caltrain given the current TTC design of 3 platforms for HSR and two platforms for Caltrain. This assumption was for EIR evaluation purposes only and does not limit the number of trains that may travel to TTC. TJPA has also conducted ridership studies and has found higher levels of ridership for the TTC with increasing service levels. The comparison of potential ridership at the 4th and King Station and the TTC with varying service levels is shown in Table 4-21.

Table 4-19. Daily Ridership Projections, 2040 No Project and Project Scenarios[a]

Station	Existing Conditions	2040 No Project	2040 Project
Transbay Transit Center	N/A	N/A	8,530 (2 trains to TTC)
4th and King	10,790	16,560	15,230
22nd Street	1,310	2,860	3,290
Bayshore	200	1,040	1,700
South SF	360	1,000	1,200
San Bruno	440	960	1,200
Millbrae	3,260	6,500	8,960
Broadway	-	0	440
Burlingame	790	1,320	1,440
San Mateo	1,570	2,530	3,280
Hayward Park	330	1,510	1,420
Hillsdale	2,320	4,040	6,000
Belmont	510	820	1,090
San Carlos	1,140	1,890	1,900
Redwood City	2,620	5,170	5,670
Atherton	-	0	430
Menlo Park	1,500	2,180	2,140
Palo Alto	5,470	9,820	13,540
California Avenue	1,290	1,990	1,500
San Antonio	680	1,110	1,280
Mountain View	3,880	6,700	9,570
Sunnyvale	2,270	3,480	4,630
Lawrence	700	1,410	1,750
Santa Clara	820	950	930
College Park[b]	--	--	--
San Jose Diridon	3,490	6,640	10,600
Tamien	810	1,360	1,880
Total	**46,560**	**81,820**	**109,590**

Note: Daily Ridership is presented as passenger boardings, defined as the number of passengers who board a train at a given station (not boardings plus alightings). Numbers may not match totals due to rounding.

[a] Excludes boardings south of Tamien Station.

[b] No service increases are proposed at the College Park Station and ridership at this station is very low at present (118 boardings/day). While College Park boardings are included in overall system ridership estimates, no analysis of localized traffic around this station was conducted given the low level of boardings and lack of proposed service increases.

Source: Appendix D

Table 4-20. Estimated Daily Ridership, Proposed Project and No Project Alternative

Operator	2013 Observed	2040 No Project	2040 Project (& DTX/TTC)
Caltrain	47,100	83,900	111,100
BART	366,600	678,900	676,900
SamTrans Bus (Local and BRT)	39,800	103,200	100,000
VTA Light Rail	34,600	129,300	129,900
VTA Bus (Local and BRT)	103,100	246,100	247,100
MUNI Metro	173,500	252,200	250,100
MUNI Bus	531,700	736,600	740,200
Shuttles (Caltrain + Private)	NA	20,700	27,000
Total	***1,297,700***	***2,311,600***	***2,332,600***

Source: Appendix I, *Ridership Technical Memorandum*

Table 4-21. Comparison of Potential Caltrain Ridership to TTC with Varying Service Level Assumptions (Boardings and Alightings by Station)

	Service	4th and King/ 4th and Townsend	Transbay Transit Center	Total of 2 Stations
Cambridge Systematics (2009) (1)	6 trains to 4th and King	30,900	N/A	30,900
	6 trains to 4th and Townsend and to TTC	17,100	31,500	48,500 (2)
PCEP DEIR System-wide Ridership Modelling (2014) (3)	6 trains to 4th and King	31,782	N/A	31,782
	4 trains to 4th and King 2 trains to 4th and Townsend and TTC	29,058	17,053	46,112 (2)

Notes:
For 2030. Estimates prepared in 2008 based on pre-recession growth forecasts.
Totals may not match due to rounding.
For 2040. Estimates prepared in 2013 based on post-recession growth forecasts.

Below, potential cumulative effects on transit infrastructure and other cumulative transit projects are discussed.

Need for Transit Infrastructure due to Ridership Increase

Cumulative growth in the region will increase demand for increased transit service. The Proposed Project is one of many projects in the planning phase to address that increased demand. Table 4-3 includes a number of key other transit projects as well, but there are many other regionally significant transit improvement efforts not included in Table 4-3 because they are in locations more distant from the Caltrain ROW.

One concern is that the Proposed Project, might result in increased ridership not only for Caltrain but also for other transit systems. The increase in ridership on other systems alone is not a concern for the CEQA evaluation, unless that increase in induced ridership would result in changes in physical conditions such as through the construction of additional transportation infrastructure to

address the increased ridership. As discussed in Section 3.14, *Transportation and Traffic*, the Proposed Project is not expected to result in a significant change in ridership for other transit services that would result in the need for new transportation infrastructure. As shown in ~~Appendix I, *Ridership Technical Memorandum*,~~ Table 4-20, compared with 2040 No Project conditions, the Proposed Project is expected to slightly lower ridership on BART, SamTrans, and ~~Muni~~ MUNI Metro and slightly increase ridership on VTA light rail (0.5 percent), VTA bus (0.4 percent) and ~~Muni~~ MUNI bus (~~0.5~~ 3 percent). Like Caltrain, other transit providers must plan for their future needs and construct the facilities to meet their system rider demands as feasible given funding availability. The Proposed Project would also contribute substantially to increases in Caltrain and private shuttles. Where the Proposed Project would result in increased bus ridership (VTA, ~~Muni~~ MUNI, and shuttles), it is not expected to require substantial new facilities to support the increase, although it would contribute to the need for bus shelters, stops, and maintenance facilities. Where the Proposed Project would contribute to VTA light-rail ridership, it may contribute to the need for additional light-rail infrastructure, which might result in environmental impacts during construction.

Because infrastructure improvements for transit services other than Caltrain and their funding are outside the responsibility of the JPB, the responsibility for managing the environmental effects of any additional transit facilities or service that might be necessary to meet future cumulative demands lies with each transit operator. For future improvements that may be necessary to accommodate increased Caltrain shuttle service due to increased ridership from the Proposed Project, such as shuttle bus stops, shelters, or other facilities, Caltrain will be required to complete the appropriate state (and federal if required) environmental review for such improvements and shall adopt feasible mitigation for any significant environmental impacts thus identified. For future improvements that may be necessary to accommodate increased other transit service due to increased ridership from the Proposed Project, the responsible transit operations will be required complete the appropriate state (and federal if required) environmental review for such improvements and shall adopt feasible mitigation for any significant environmental impacts thus identified.

At this time, it appears unlikely that the relatively modest increases in ridership for other transit services resultant from the Proposed Project would result in the construction of additional transit infrastructure that might have significant physical impacts on the environment and thus the Proposed Project's contribution to cumulative need for transit infrastructure is less than considerable.

Potential Conflicts between Proposed Project and Other Transit System Projects

Caltrain routinely coordinates with other transit system providers to facilitate Caltrain and other system transit projects and to avoid conflicts between planning for different systems. Caltrain has coordinated and is continuing to coordinate with CHSRA on the HSR project, TJPA on the DTX project, BART on the Silicon Valley Extension and other projects and has not identified any conflicts between the Proposed Project and these projects that would hinder their completion as proposed. Similarly, Caltrain is taking into account the future service plans of other passenger rail operators when planning for the South Terminal improvements.

At this time, only three potential conflicts between the Proposed Project and other proposed transit projects have been identified. If conflicts could not be resolved, there is the potential for significant impacts in the loss of transit service which could then result in increased vehicle traffic and resultant traffic congestion and air quality impacts (as well as possibly other environmental effects).

However, as discussed below, each of the potential conflicts appears manageable without impeding other transit projects/service and/or the creation of substantial new environmental effects.

DTX

As described above, the DTX project's 2004 FEIS/EIR included ~~proposes a~~ reconfiguration of the San Francisco 4th and King Street station ~~yard~~ from six at-grade platforms (12 tracks) to three at-grade platforms (six tracks) ~~at 4th and King,~~ in the southern portion of the railyard; permanent realignment of approach tracks south of the 4th and King Station within the Caltrain right-of-way bordering 7th Street, and a new underground station at 4th and Townsend streets. Subsequent to the 2004 FEIS/EIR, the platform and track reconfiguration at the railyard was removed from the DTX project scope during the Preliminary Engineering phase.

TJPA clarified in its comment letter on the PCEP DEIR that the railyard platform reconfiguration under the DTX project is limited only to work necessary to create space for DTX construction, consistent with the current DTX scope. Based on this clarification, construction of the DTX project would not require platform modifications either for existing Caltrain service or for proposed Caltrain electrification service. If such reconfiguration were to be desirable in the future for other purposes, a separate environmental review involving Caltrain (and possibly other parties) may be warranted to evaluate impacts of surface station and/or track reconfiguration at the 4th and King Street Station. At present, no plans or funding have been identified to implement the surface station and track reconfiguration.

The DTX project could result in two effects to the electrified Caltrain railyard and its operations.

- First, the DTX project could result in temporary disturbances to the north side of the railyard during construction. Caltrain has coordinated with TJPA and identified that DTX construction may require temporary relocation of OCS infrastructure (poles and wires) in certain portions of the railyard during construction. If funding is identified and surface station reconfiguration and associated approach track relocation is carried out before DTX construction, then no track relocation at the railyard would be required as part of the DTX construction. In this scenario, DTX construction would not impact the OCS poles and wires that would be installed for the reconfigured station design.
- Second, as noted previously, the DTX project also requires realignment of approach tracks south of the 4th and King Station within the Caltrain ROW bordering 7th Street. This work would require permanent relocation of the OCS poles and wires along with the realigned tracks. Temporary or permanent relocation of OCS poles and wires associated with 4th and King Station reconfiguration (if not completed prior to DTX construction), would involve a minor increase in DTX cost compared to the overall DTX construction effort.

As described above, Caltrain ridership to the TTC will depend on Caltrain service to the TTC. Although the modeling for this EIR assumed two trains per peak hour to the TTC and fourth to the 4th and King Station, this assumption was for EIR evaluation purposes only. Because the project limits for the PCEP end at the 4th and King Station, the exact level of service to TTC is outside the PCEP's scope and is dependent on ultimate resolution of the TTC design, which is a matter to be resolved between TJPA and Caltrain (and other parties) (which is also outside the scope of the PCEP). The PCEP project would bring up to 6 Caltrain EMU trains per peak hour per direction to the 4th and King Station. The total number of trains that could proceed all the way to TTC shall be determined in the future and will depend on ultimate platform, track design, and operational

parameters at TTC, that are yet to be determined. The PCEP does not preclude a greater number of trains travelling to TTC.

Therefore, there is no substantial conflict between the PCEP and the DTX/TTC projects.

Caltrain Fourth and King Terminal Platform Reconfiguration

If ~~the DTX~~ platform reconfiguration ~~project~~ could ~~have been~~ be completed before the Proposed Project, then electrification would only need to be applied to the six tracks at the station itself. However given funding constraints, full platform reconfiguration will happen after 2020 ~~it appears likely that the DTX project will be completed sometime after 2019 and~~, thus, that the Proposed Project will electrify the 12 existing tracks at the station. This will likely mean that the ~~DTX project~~ platform reconfiguration will have additional construction effort to remove and relocate electrical infrastructure at the 4th and King Station/Yard to match the new configuration sometime after 2020 ~~2019. Given the scale of the DTX project, the additional effort will be an additional cost, but a limited one by comparison to the cost of DTX overall.~~ Given the uncertainty as to ~~DTX~~ funding and timing, the electrification of the 4th and King Station as is will allow for the commencement of electrified service with all of its identified benefits without an uncertain delay that might occur if funding for platform reconfiguration ~~DTX~~ takes some time to secure. Environmentally, the additional effort to remove and relocate the poles and wires at the station would be a minor increase in terminal reconfiguration ~~DTX~~ construction effort overall. ~~given the need for DTX to construction substantial tunneling, underground station infrastructure, and platform reconfiguration.~~

Relocation of OCS poles and wires would not be a major impediment to future station platform reconfiguration. The estimated cost to electrify the entire 4th and King Station and yard is $13.5 million. This cost would fall on the Proposed Project. If and when the 4th and King Station platforms are reconfigured, assuming the TJPA 2004 EIS/EIR reconfiguration design, the cost to electrify the reconfigured tracks and platforms would be $7 million. This $7 million additional cost is not considered an insurmountable financial hurdle to platform reconfiguration, regardless of who ultimately implements the reconfiguration. Caltrain would prefer to electrify the 4th and King Station after reconfiguration to help avoid additional cost as well as disruption to its riders, but at this time due to funding limitations that does not appear likely.[22] ~~Caltrain will continue to coordinate with TJPA to examine if there is an opportunity to coordinate construction of the Proposed Project and station reconfiguration to minimize the need for additional work.~~

SFMTA 22-Fillmore Electric Trolley Bus Re-Routing to 16th Street

SFMTA is proposing to re-route the 22-Fillmore electric trolley bus (ETB) from its current route crossing over the Caltrain ROW at 18th Street to an at-grade crossing at 16th Street. The installation of the direct current 600-volt OCS for the electric trolley bus at 16th Street creates a conflict with the proposed installation of the 25 kVA alternative current OCS as part of the Proposed Project.

The ETBs have an auxiliary power unit (APU) that can operate the bus without electrical power for short distances. While it would be technically feasible for the ETB to pull down the collector poles prior to driving through the 16th street rail crossing (to avoid contacting the Caltrain 25 kVA OCS wire), this is considered unacceptable from both a safety and an operational standpoint. A bus stopping to disconnect and re-attach the collector poles while on a railroad crossing is not safe and a

[22] The Proposed Project does not include adequate funding for any station improvements or reconfiguration other than installation of electrification infrastructure.

bus stopping before and after the railroad crossing would delay bus service times and create traffic safety issues.

In order to manage the conflict to allow the SFMTA project and the Proposed Project to both go forward, Mitigation Measure TRA-CUMUL-2 is proposed. With implementation of this mitigation, both projects would be able to proceed and provide their improved transit benefits.

Mitigation Measure TRA-CUMUL-2: Implement technical solution to allow electric trolley bus transit across 16th Street without OCS conflicts in cooperation with SFMTA

The JPB, in cooperation with SFMTA, will implement a technical solution to allow operation of the ETB at the 16th street crossing as well as the Caltrain electrification.

Two feasible options for the SFMTA at-grade trolley crossing at 16th Street underneath the I-280 viaduct have been identified, both of which would involve a short phase break of the Caltrain OCS. Both options would include a short gap in the Caltrain OCS to allow the ETB OCS to be installed through the intersection. The short section of the ETB OCS would not be energized to avoid any potential for contact between energized parts of the Caltrain OCS and the ETB OCS. The options for equipment to facilitate Caltrain operations through the Caltrain OCS gap are as follows:

- Option #1: Installation of a track-mounted transponder that automatically communicates with special on-board equipment to open the main circuit breaker and preclude current from reaching the car.
    - As a Caltrain consist approaches the 16th street crossing, the engineer would reduce the power draw and the track-mounted transponder would instruct the individual car to open its main breaker. Power drawn from pantographs outside the "zero-power zone" will allow the train to move through the crossing without slowing down. After clearing the crossing, the main breaker will close, and the power draw can be ramped up again.
    - Electric Trolley Buses will operate normally at the crossing, as the collector poles glide along the contact wires up to 6" above the 25kV Caltrain OCS wires. Buses will encounter a roughly 6-foot-long (the width of the Caltrain pantograph) non-energized portion of contact wire at the crossing of each track, but can coast through that gap on a continuous wire structure. This type of movement is a part of normal operations in San Francisco.
    - This type of OCS wire structure has been used previously in Seattle and in Europe.
- Option #2: Installation of a vacuum circuit breaker (VCB), which removes the requirement for special on-board equipment.
    - The VCB solution has only been available for about 15 years and has not been implemented on a large scale yet. This solution has been utilized in newer installations in China.

Caltrain will need to obtain regulatory clearance from the CPUC for either of these solutions. The CPUC has not yet released regulations for 25kV traction power systems. The rulemaking process is ongoing. Caltrain, in cooperation with SFMTA will work with the CPUC to obtain approval of a technical solution for the 16th Street crossing.

The placement of the ETB overhead wires needs to be identified by SFMTA in coordination with Caltrain as the ETB needs to cross in the lane with the overhead wires in order to avoid any power interruption for the bus while crossing the rail line.

The following issues will be resolved during design of the improvement: wire height for the 22-Fillmore OCS, reliability of the Caltrain on-board (transponders), or off-board equipment, (vacuum circuit breakers), and emergency operating procedures in case of failure.

In addition, Caltrain will work with SFMTA to identify any design, maintenance, or emergency contingency considerations important to the design of the crossing system to minimize additional maintenance effort or materials for SFMTA during operations and to identify emergency response actions in the event of any wire entanglement at the crossing.

BART Millbrae Tail Tracks

As described above, the BART Millbrae Tail Track project would extend the existing tail tracks at the BART Millbrae Station 200 to 300 feet southward on BART property. In this area, the OCS would be installed within the Caltrain ROW so there should be no conflicts with the BART extension project.[23]

Pedestrian Facilities

Cumulative projects could also affect pedestrian walkways and bike paths that cross the Caltrain ROW or are directly adjacent to the Caltrain ROW. Blended Service improvements would have the greatest potential to affect such facilities if passing tracks are proposed outside the Caltrain ROW. For example, the Embarcadero bike path is parallel to the Caltrain ROW and in Palo Alto and the Middle 3 passing track option would include this portion of Palo Alto. Whether or not passing tracks affect bicycle and pedestrian facilities would depend on location and design, which are unknown at this time.

As discussed in Section 3.14, *Transportation and Traffic*, the Proposed Project would add increased pedestrian volume to existing pedestrian facilities due to increased ridership. The existing pedestrian facilities have been evaluated and are capable of accommodating an increase in pedestrian traffic with the exception of pedestrian facilities around the San Francisco 4th and King Station. Future planned pedestrian facilities are designed around the Proposed Project's existing alignment. Planned pedestrian facilities will be constructed to accommodate Caltrain's existing alignment. Therefore the Proposed Project would not contribute to cumulative impacts on pedestrian facilities at locations other than the 4th and King Station.

At the 4th and King Station, due to increased Caltrain ridership (with or without the Proposed Project) in combination with increased transit ridership on connecting services including the Central Subway and the proposed Embarcadero Streetcar extension, as well as general growth in the 4th and King Station vicinity, the capacity of some of the pedestrian facilities will be exceeded, resulting in congested walkways and crosswalks around the station and queuing to cross local streets. Because the Proposed Project would increase Caltrain ridership compared with No Project conditions, the Proposed Project would contribute considerably to pedestrian usage of the 4th and King Station area. Thus, the Proposed Project will contribute considerably to a cumulative pedestrian facility impact at 4th and King Station.

[23] As discussed in Section 3.5, *Electromagnetic Fields and Electromagnetic Interference*, during final design Caltrain will assess the potential for EMI between the Caltrain OCS and BART signal and communication systems and address it through design features such as s filters, capacitors, and inductors.

As discussed in Section 3.14, *Transportation and Traffic*, the Proposed Project would only contribute to this impact between when the Proposed Project begins operations in 2020 ~~2019~~ and when DTX/TTC becomes operational. At that point, with ridership shifting to TTC, the Proposed Project would no longer have a considerable contribution to pedestrian usage because the Proposed Project's contribution would be less than under No Project conditions.

Mitigation Measure TRA-3b (discussed in Section 3.14, *Transportation and Traffic*) would require the JPB and the City and County to plan for and implement necessary pedestrian facility improvements to the 4th and King Station and adjacent pedestrian facilities in City street rights-of-way. Implementation of this mitigation measure would reduce the Proposed Project's contribution to a cumulative impact to a less than significant level.

Bicycle Facilities

The Proposed Project, in combination with other cumulative projects may also increase future demand for bicycle facilities however, most plans in the project area account for increased bicycle volumes through added bicycle infrastructure. The Proposed Project does not change the alignment and does not impede any existing or planned bicycle projects because the new improvements are limited to overhead infrastructure and the TPFs (which do not affect bicycle facilities).

For the Caltrain system itself, the increase in ridership over time will likely increase the demand for bicycle facilities at Caltrain stations. Given that bike trains often operate at capacity during peak periods under existing conditions, it is possible that capacity issues may continue in future years. Any unmet on-board demand for bikes-on-board could be accommodated through the provision of increased bike parking at stations. This would allow passengers to safely and securely park their bikes before boarding the train. If a passenger is in need of a bike to egress from their destination station, they may also be able to use Bay Area Bike Share or travel by another mode.

As explained in Section 3.14, *Transportation and Traffic*, Caltrain's *Bicycle Access and Parking Plan,* includes a long-term plan to increase bicycle parking supply for a variety of user needs, improving station access for bicyclists, working with cities to improve station bike access, as well as considering other station-side concepts.

Mitigation Measure TRA-4b, in Section 3.14, *Transportation and Traffic*, would require Caltrain to continue implementation of its current planning to improve bicycle facilities at Caltrain stations over time to meet potential increased demand for such facilities. Thus, with mitigation, the Proposed Project would not contribute considerably to any significant cumulative impacts on bicycle facilities.

Emergency Vehicle Access

Cumulative projects would affect existing emergency vehicle access if they result in constrictions on the ability for emergency responders to reach their destinations. This could occur due to physical constraints and/or generation of traffic congestion which could impede emergency vehicles. However, peak period traffic congestion generally does not result in delay for emergency vehicles, which have right-of-way and often utilize multi-lane major arterials for access. Emergency vehicles are permitted to use transit-only lanes or other vehicle-restricted lanes if necessary.

The increase of cumulative rail traffic along the Caltrain ROW including HSR, ACE, Capitol Corridor, DRC, the Coast Daylight and freight could result in increased gate down times at the at-grade crossings along the Caltrain ROW. As discussed above, due to cumulative growth in traffic over time due to both the land use projects (included in Table 4-3) as well as general growth in the region (as

shown by projections in Table 4-2), traffic conditions are expected to substantially decline over the next few decades both at the at-grade crossings of the Caltrain ROW but also generally throughout the region (in spite of substantial investments in transit). With this cumulative growth in traffic, emergency response times during peak hours may be adversely affected.

Despite these localized traffic delay impacts, emergency vehicle response times are a function of travel along the entire path from their base to the incident location. The Proposed Project overall would substantially reduce overall vehicle miles travelled in the Peninsula corridor by approximately 235,000 miles/day in 2020 and 619,000 miles/day in 2040 (compared with No Project Conditions) which would substantially improve congestion on a broad general basis. Most of the VMT reductions would be during peak hours, which is especially important in reducing congestion. The broad-based congestion improvement is expected to more than offset the localized effects at individual at-grade crossings and near Caltrain stations and result in a net improvement (compared with No Project Conditions) in the emergency response times.

As discussed in Section 3.8, *Hazards and Hazardous Materials*, the Proposed Project's new OCS would not pose an impediment to routine emergency vehicle access.

Station Parking/Access

As described in Section 3.14, *Transportation and Traffic*, the Proposed Project does not interfere with the implementation of Caltrain's *Comprehensive Access Program Policy Statement* or *Bicycle Access and Parking Plan*. The Proposed Project would also increase both vehicular and pedestrian traffic around Caltrain stations but locations with high vehicle volumes are signalized and allow pedestrians to cross safely. No additional new at-grade crossings are planned with the Proposed Project and the implementation of CBOSS PTC further improves safety. Under cumulative conditions, there would be a further increase in traffic and pedestrian volumes by 2040, but a similar conclusion applies and the Proposed Project would not contribute considerably to any cumulative access safety impacts.

The remainder of this section concerns station parking and access facilities.

Modeling of potential parking demand was completed for informational purposes based on behavioral forecasts by Fehr & Peers (see Appendix D, *Transportation Analysis*). Actual parking demand will fluctuate based on day and month based on peoples changing mode of access to Caltrain. The parking supply and demand forecasted for 2040 is shown in Table 4-22 ~~19~~. Parking supply remains the same with and without the project while parking demand increases.

Without the Proposed Project, 2040 ridership will still increases, causing parking demand that will exceed Caltrain supply at 11 stations. At some stations, this parking deficit will likely be absorbed by existing non-Caltrain lots and on-street parking at stations such as San Mateo, Hillsdale and San Jose Diridon. Four stations will have demand that exceeds both Caltrain and nearby non-Caltrain parking supply. At the Mountain View and Sunnyvale Stations, the demand will exceed the Caltrain and non-Caltrain parking supply by more than 100 spaces.

The cumulative parking demand presented in this analysis does not take into account parking demand from High-Speed Rail or proposed TOD developments. TOD development could increase or decrease local parking demand depending on their specific design and approach to shared parking. HSR parking impacts will need to be assessed as part of subsequent environmental evaluation by CHSRA as parking demand is highly tied to the specific timing, mode of access and schedule for HSR service, all of which are not known in sufficient detail at this time.

Table 4- 22 ~~19~~. Existing and Future 2040 Cumulative Parking Supply at Caltrain Stations

Station	Existing		2040 without Project			2040 with Project		
	Caltrain Lot Utilization	Caltrain Lot Parking Supply	Parking Demand	Parking Surplus & Deficit[a]	Excess Parking Demand[b]	Parking Demand	Parking Surplus & Deficit[a]	Excess Parking Demand[b]
4th and King	-	0	169	-169	39	77	-77	0
22nd Street	-	0	514	-514	0	779	-779	157
Bayshore	13%	38	54	-16	0	114	-76	0
South SF	51%	74	75	-1	1	113	-39	39
San Bruno	22%	201	215	-14	0	304	-103	0
Millbrae[c]	80 ~~79~~%	490	332	158	0	455	35	0
Broadway[d]	8%	122	-	-	-	35	87	0
Burlingame	30%	69	55	14	0	74	-5	0
San Mateo	20%	42	190	-148	0	359	-317	0
Hayward Park	3%	210	28	182	0	37	173	0
Hillsdale	86%	513	615	-102	0	1,112	-609[e]	503
Belmont	20%	375	82	293	0	135	240	0
San Carlos	32%	207	210	-3	0	243	-36	0
Redwood City	46%	553	331	222	0	588	-35	0
Atherton[d]	-	96	-	-	-	44	52	0
Menlo Park	33%	155	82	73	0	118	37	0
Palo Alto	87%	350	232	118	0	393	-43	43
California Avenue	31%	169	52	117	0	59	110	0
San Antonio	33%	193	47	146	0	115	78	0
Mountain View	97%	336	811	-475	119	1,379	-1,043	687
Sunnyvale	103%	391	750	-359	296	1,291	-910[f]	847
Lawrence	30%	122	105	17	0	143	-21	0
Santa Clara	62%	190	33	157	0	32	158	0
College Park[g]	--	--	--	--	--	--	--	--
San Jose Diridon	99%	576	239	337	0	380	196	0
Tamien	98%	275	853	-578	0	1,205	-930	301
Total Excess Demand					**455**			**~~2,578~~ 2,577**

Source: Appendix D, *Transportation Analysis*

[a] High parking surplus can be attributed to changes in land use where parking currently exists in some cases

[b] Excess Park and Ride demand beyond non-Caltrain lot and on-street parking

[c] Includes shared parking with BART.

[d] No weekday service at present. Weekday service would be restored with Proposed Project but not with No Project.

[e] Includes potential loss of 10 spaces due to PS-4, Option 1.

[f] Includes potential loss of 10 spaces due to PS-6, Option 2.

[g] There is no Caltrain lot at the College Park Station. Parking is on the street. Given limited ridership and no plans to change service levels, parking demand was not evaluated at this location.

The increase is greater with the Proposed Project due to increased ridership. As shown in Table 4-22 ~~19~~, the majority of parking deficits could be absorbed by on-street parking and/or non-Caltrain lots where space is available.[24] In 2040 with the Proposed Project, parking demand will exceed the Caltrain and Non-Caltrain parking supply at seven stations, five of which will have demands that exceed the supply by more than 100.

At the 4th and King, Hayward Park, Santa Clara, San Jose Diridon and Tamien Stations, parking demand decreases from the 2020 to 2040. This demand decrease can be attributed to planned cumulative future transit-oriented development, contributing to increasing riders who access Caltrain via transit, walking and bicycling. It should be noted that land use changes in the station area contributing to parking demand decrease may decrease the parking supply as well. Subsequently, this planned development may result in lower parking surplus.

At most stations where impacts occur with the Proposed Project, they also occur without the project, though to a lesser extent.

An area of substantial change for the future is the area around the San Jose Diridon Station. The cumulative analysis of parking for the Diridon Station Area has been recently assessed in the certified 2014 Final EIR for the DSAP, which includes transit demand. In the FEIR for the DSAP, the City of San Jose specifically noted in response to comments from Arena Management that the DSAP EIR analysis of full buildout included BART and rail electrification (City of San Jose 2014b). The DSAP EIR's analysis of cumulative parking demand is incorporated by reference for the PCEP EIR.

The DSAP proposes to meet demand generated by existing and future development by requiring that new development provide off-street parking, primarily through structured or underground garages. The DSAP projects future off-street parking ratios that would ultimately be achieved with build-out of the DSAP and completion of the planned transit facilities, including BART and High Speed Rail. Already a major transit hub, Diridon Station is anticipated to become one of the busiest multi-modal stations both in California and the western United States with the BART extension to Silicon Valley and the High Speed Rail to San Francisco and Los Angeles (City of San Jose 2014b).

In addition to these major investments, the DSAP also plans for a dense network of bicycle and pedestrian facilities that will further improve access to the Plan area from the surrounding communities. Given the planned high level of transit, bicycle, and pedestrian accessibility, it is anticipated that more people will travel to the Diridon area using an alternative mode of transportation than by driving alone, thereby necessitating the need for less parking than is currently required in Downtown for office/R&D and hotel uses(City of San Jose 2014b).

The parking demand for transit services accounted for by the DSAP under build-out conditions is projected to range from 1,350 to 2,200. The DSAP does not propose to supply new parking facilities specifically for transit users. Rather, the parking demand would be met through surplus spaces to be provided in the new structures associated with future development (City of San Jose 2014b).

To continue to meet parking demand generated by the Arena, the existing 1,400-space (approximately) surface lot would remain under build-out conditions. In addition, the DSAP includes a 900-space, 2 to 3 level parking structure to provide additional shared parking for the general public. The garage would be located at the northeast corner of St. John Street and Montgomery Street, north of the Arena (City of San Jose 2014b).

[24] There could be competition for excess parking locations with future residential or commercial development.

Based on the projected parking ratios, maximum development levels, and projected transit parking demand, the total recommended parking supply in the DSAP area would be approximately 11,950 spaces. As described above, parking would be supplied by future development in the form of structured or underground facilities and would provide a modest surplus of just over 600 spaces when full-build out is achieved over the 30-year life of the DSAP (City of San Jose 2014b). Thus, while the PCEP does not propose to add any additional parking facilities as part of the project or as mitigation, the DSAP has providing an overall approach to considering and addressing cumulative parking taking into account planned development and planned transit and has provided for meeting that demand.

Caltrain's 2010 *Comprehensive Access Program Policy Statement*, emphasizes station access by walking, transit, and bicycling over automobile access at most stations. The policy targets different access strategies at different stations based on the station characteristics and access opportunities. For example, the San Francisco 4th and King Station is a transit center where the access priority for autos is the lowest priority after transit, walking and bicycle. At intermodal connectivity and neighborhood circulator stations, auto access is not a priority. At auto-oriented stations, auto access is the primary priority access mode followed by biking.

Since some of the parking deficits identified above are at stations where providing automobile access is not a priority, provision of substantial additional parking facilities at these stations would conflict with Caltrain's *Comprehensive Access Program Policy Statement*. Where parking deficits are at auto-oriented stations, provision of additional auto parking would be a priority, where feasible. The *Comprehensive Access Program Policy Statement* is implemented by Caltrain in cooperation with local jurisdictions as part of Caltrain's long-term planning and capital improvement program; however access improvements are implemented on a funding available basis. Caltrain also works with local jurisdictions, other transit agencies, and local, state and federal funding partners to fund improvements to access to Caltrain stations via alternatives to automobiles including transit connections, bicycle and walking. Where future investments in these access modes are realized, they will help to reduce some of the excess parking demand. Caltrain is also working with many local jurisdictions concerning transit-oriented developments including exploring shared parking opportunities where appropriate.

However, despite these efforts, given the funding limitations and long-term nature of Caltrain's implementation of its *Comprehensive Access Program Policy Statement*, it is likely that not all of the parking deficits will be addressed when the Proposed Project is in operation.

A parking deficit in and of itself, or the need to find a parking space off-site, while inconvenient is not inherently a significant physical impact on the environment. Some station users unaware of the parking deficits may circle[25] but experienced station users will modify their behavior to take into account the parking deficits and take alternative actions. Those actions may include arriving earlier, using other nearby stations with available parking[26], using the kiss and ride, using parking areas further from the station, or accessing the station via other modes such as transit, biking or walking. At the extreme, lack of vehicle parking could result in some riders deciding to use an alternative transit system, carpool, or drive to their destination alone. This could result in lower Caltrain

[25] While circling vehicles may result in additional vehicle emissions, traffic and traffic noise, additional circling is not likely result in substantial additional criteria pollutant emissions, traffic, or noise around Caltrain stations above the thresholds used in this EIR.

[26] For example, users of the Hillsdale Station could utilize the nearby Hayward Park and Belmont Stations, which are forecasted to have a parking surplus in 2040.

ridership than estimated in this EIR. As an unrealistic worst-case example, if the system deficit of approximately 2,100 spaces in excess of the Proposed Project were to mean 2,100 fewer Caltrain riders, then 2040 ridership would be 2 percent less than predicted. However, given that the Proposed Project would still result in a substantial ridership increases (approximately 25,000 in 2040 compared with the No Project conditions) even in this worst-case situation, the environmental consequences would be less than significant as the Proposed Project benefits to regional traffic, noise, air quality, and greenhouse gases would still be substantial (though slightly smaller). In this scenario, the localized traffic impacts around the stations with parking deficits would be slightly better than with full ridership.

The other potential impact of a parking deficit in and around Caltrain stations would be the potential increased demand for additional off-site parking facilities, the construction of which might result in other secondary environmental impacts. However, as described above, Caltrain expects that the dominant response to parking deficits, such as they actually occur, will be behavioral change on the part of the commuting public, rather than the speculative construction of new off-site parking facilities.

Thus, while the Proposed Project may contribute to a cumulative parking deficit, even with implementation of its access program, as described above this is not considered to result in a significant environmental impact and thus the Proposed Project would not contribute considerably to a cumulatively significant impact related to air quality, noise, traffic or greenhouse gas emissions or the secondary impacts of construction of parking facilities.

Impact to Freight Service

Cumulative rail service increases along the Caltrain corridor could have impacts upon ~~affect~~ existing freight service ~~in two ways: 1) through time constraints due to the requirements for temporal separation between Proposed EMUs and freight trains in the FRA waiver, if applicable; and 2)~~ through the interaction of potential height restrictions due to OCS installation with future proposals by freight operators to use freight equipment taller than today's freight equipment.

As discussed in Chapter 2 and Section 3.14, Transportation and Traffic, the Proposed Project presumes that temporal separation will not be required and thus that changes to freight operational windows will not be necessary. Thus, this analysis focused on potential constraints on freight heights.

The existing levels of freight are approximately 3 round-trip trains per day in the Caltrain corridor north of Santa Clara. On an average day there are an estimated 150 loaded cars per day hauled on the Caltrain corridor and tonnage per loaded car ranges from 85 to 115 tons with an average of 100 tons of cargo per railcar (Greenway pers. comm.). This is only a rough estimate and daily averages can vary substantially based on economic conditions, customer needs, type of freight cargo being handled, equipment available and other factors. Based on these assumptions, on average approximately 15,000 tons of freight is being hauled on the Caltrain corridor per day. Assuming truck loads of 20 to 25 tons, this amount of rail freight is equivalent to that which could be carried by 600 to 750 trucks loads.

Local daily freight moves along the Caltrain corridor in length vary from approximately 5 to 7 miles

("South City Local" from the Port of San Francisco to South San Francisco[27]) to 16 to 18 miles ("Broadway" from South San Francisco to the Port of Redwood City) to 35 to 38 miles ("Mission Bay" from South San Francisco to San Jose Newhall Yard) in length. Freight hauling from more distant locations would have much larger hauling length. While the exact ton-miles per day hauled along the Caltrain corridor on average each day is not known, if the daily average of 150 loaded rail cars is evenly divided between the three daily moves, then the average freight service could be estimated as approximately 300,000 ton-miles.

~~***Cumulative Impacts on Freight Service due to Cumulative Increase of Rail Service and Constrained Operational Windows***~~

~~The Proposed Project would result in restriction of freight to midnight to 5 a.m. (compared with approximately 8 p.m. to 5 a.m. at present[28]) along the portion of the Caltrain corridor north of Santa Clara (north of CP Coast) due to the temporal separation requirements of the FRA waiver. As discussed in Section 3.14, *Transportation and Traffic*, while inconvenient and requiring change in freight operational practices north of Santa Clara, the compression of freight service hours to midnight to 5 a.m. would not be expected to result in a diversion of freight hauling from freight trains to trucks (or other modes) at existing levels of freight service.~~

~~The FRA waiver requirements cannot be altered by the JPB on its own; only FRA can decide if temporal separation should be required or not for alternately compliant light-weight EMUs. If FRA decides that temporal separation is not required in the current rule-making, then it would likely be feasible to accommodate the moderate increases in freight included in this analysis without diversion to truck or other modes.~~

~~Operations of Amtrak, ACE, DRC and Capitol Corridor would not constrain freight as these services operate FRA-compliant vehicles and primarily operate during the day (ACE and Capitol Corridor only operate south of Santa Clara where there are dedicated freight tracks).~~

~~The FRA-compliant vehicles are heavier and have the structural strength to operate on the same tracks as freight without the temporal separation (BART 2008).~~

~~Blended Service is proposed to operate between 5 a.m. and 12:30 a.m. This would further constrain freight operating hours by an additional 30 minutes north of CP coast compared with the Proposed Project, given the temporal separation requirements of the FRA waiver, if applicable. With Blended Service, freight would be limited to 4.5 hours between 12:30 a.m. to 5:00 a.m. between Santa Clara and San Francisco.~~

~~At present, approximately three round-trip trains operate in this part of the Caltrain corridor and this could increase to perhaps six round-trip trains by 2040. For this analysis it was assumed that~~

[27] The San Francisco to South San Francisco round trip is not presently completed in a single night. The long-haul trains used on the Caltrain corridor are six-axle trains and the Quint Street Lead can only handle four-axle trains. As a result, the trains making this trip must make an equipment change in mid-trip (from a six-axle locomotive to a four-axle locomotive and vice versa). This change involves many hours related to charging the brake system with air, brake testing and a crew change. Thus, the round-trip takes 24 hours at present.

~~[28] As explained in Section 3.14, *Transportation and Traffic*, the Trackage Rights Agreement (TRA) provides that between midnight and 5 a.m., at least one main track will always be in service for freight. It also provides at least one 30-minute headway window between 10 a.m. and 3 p.m. for freight service. In practice today, freight commonly runs between 8 p.m. and 5 a.m., with occasional daytime service. Freight service hours are not limited by the TRA on the UP-owned MT-1 track between CP Coast and CP Lick (Santa Clara to south of Tamien Station). The FRA waiver requirements would not apply on the UPRR-owned MT-1.~~

~~the daily number of freight trains would double and the increase in service would mirror the pattern of daily moves at present. Thus, instead of 1 train daily making the moves discussed above, there would be two.~~

~~If freight round trips could not be completed in a single night using a single train consists, then trips may need to be staggered over several nights (as is done on the South City Local at present). Alternatively, additional trains operating in each direction (one –way transit per night) or lengthier trains could be employed in order to maintain the same level of service as a round-trip that could be completed in the same night. Another potential response could be routing of freight via rail other Bay Area ports (such as at Richmond or Oakland). Such operational changes could affect scheduling convenience, cost, and/or competitiveness for freight operators.~~

~~Given the low levels of current freight operations on the corridor, the existing freight levels can be accommodated even with a more constrained operational window and thus a significant cumulative effect on existing freight service due to Blended Service is not considered likely. However, if freight rail demand along the San Francisco Peninsula substantially increases in the future, the additional freight rail service may be more challenging to accommodate with the small operational window and, thus, some freight may be diverted to truck or other modes or diverted to other ports.~~

~~A smaller operational window is more likely to affect the longer freight moves. The South City Local already operates over a two night window due to equipment constraints and, thus, is not likely to be significantly affected by the constrained operational window. The more lengthy moves, particularly from South San Francisco to San Jose, would be more susceptible to time issues. For this analysis, a base case was analyzed consisting of diverting the freight of a daily round trip train from South San Francisco to San Jose to trucks and a more extreme case of diverting all new freight (three daily round trips over existing freight levels).~~

Cumulative Impacts on Freight Service due to Changes in Freight Heights and Vertical Clearances

The Proposed Project would lower the effective vertical clearance at a number of locations (such as tunnels and overhead structures such as bridges) along the Caltrain corridor by up to several feet due to installation of the OCS. The Proposed Project would include minor modifications at ~~three of~~ the San Francisco tunnels and at four roadway overpasses to ensure that adequate vertical clearance is provided to accommodate existing freight heights.

As discussed above, there is a potential that freight service in the future may desire to use higher freight vehicles than are currently operating on the Caltrain corridor. While the Proposed Project would provide adequate vertical clearance for existing freight vehicles (see discussion in Section 3.14, *Transportation and Traffic*), it may not accommodate potential future freight vehicles that could otherwise operate today if the OCS were not installed. Because existing freight would be accommodated, this would not be an impact over baseline. However, there is a potential for a cumulative impact when combining the effect of lowered vertical clearance <u>to accommodate</u> ~~with~~ the OCS with a change in potential freight train height in the future.

<u>Table 4-23 shows the resultant effective vertical clearances with the Proposed Project and identifies whether vertical clearances with the project would be less than existing effective vertical clearances. As shown in Table 4-23, if current freight equipment is used, then there would be no impact. If higher equipment is proposed, it would be constrained compared to existing conditions, north of the San Francisquito Bridge to Bayshore and at the Lafayette Pedestrian Overpass.</u>

Table 4-23. Changes in Effective Vertical Clearance with the Proposed Project OCS

			Existing Effective Clearance(1)			Effective Vertical Clearance with OCS (2)		Lower than Existing Effective Clearance?
Milepost	Bridge	TRA Clearance (CL)	Effective Clearance Over CL	Existing Freight Heights	Allowable Plate Height / Plate (3)	Effective Clearance Over CL	Allowable Plate Height / Plate (3)	(Y/N)
0.52	Signal Cantilever	N/A	22.48 (MT-1) 23.70 (MT-2)	15.50 / C	15.50 / C	20.44 (MT-1) 21.66 (MT-2)	15.50 / C (4)	N
0.70	Signal Cantilever	N/A	27.59 (MT-3) 28.07 (Lead Track)	15.50 / C	15.50 / C	25.55 (MT-3) 26.03 (Lead Track)	15.50 / C (4)	N
0.88	Signal Cantilever	N/A	25.45 (MT-1) 25.59 (MT-2)	15.50 / C	15.50 / C	23.41 (MT-1) 23.55 (MT-2)	15.50 / C (4)	N
1.10	Signal Bridge	N/A	25.45 (MT-1) 25.59 (MT-2)	15.50 / C	15.50 / C	22.74 (MT-1) 22.64 (MT-2)	15.50 / C (4)	N
	Signal Bridge	N/A	23.12 (MT-1) 23.12 (MT-2)	15.50 / C	15.50 / C	21.08 (MT-1) 21.08 (MT-2)	15.50 / C (4)	N
1.29	Mariposa	21.25	20.51	15.50 / C	15.50 / C	18.47	15.50 / C (4)	N
1.33	Tunnel 1	21.92 (MT-1) 21.50 (MT-2)	20.80 (MT-1) 20.60 (MT-2)	15.50 / C	15.50 / C	17.00 (MT-1) 17.00 (MT-2)	15.50 / C (4)	N
1.72	22nd St.	20.50	19.92	15.50 / C	15.50 / C	16.84	15.50 / C (4)	N
1.87	Signal Cantilever	N/A	24.81 (MT-1) 24.89 (MT-2)	15.50 / C	15.50 / C	22.77 (MT-1) 22.85 (MT-2)	15.50 / C (4)	N
1.90	23rd St.	21.00	20.25	15.50 / C	15.50 / C	17.17	15.50 / C (4)	N
1.93	Tunnel 2	21.74 (MT-1) 21.33 (MT-2)	20.70 (MT-1) 20.60 (MT-2)	15.50 / C	15.50 / C	17.00 (MT-1) 17.00 (MT-2)	15.50 / C (4)	N
3.13	Oakdale	20.50	22.68	17.08 / F	17.08 / F	20.64	17.08 / F (5)	N
3.19	Tunnel 3	21.33 (MT-1) 21.17 (MT-2)	20.80 (MT-1) 20.80 (MT-2)	17.08 / F	17.08 / F	18.00 (MT-1) 18.00 (MT-2)	17.08 / F (5)	N
4.15	Paul Ave	19.83	19.83	17.08 / F	17.08 / F	17.79	17.08 / F (5)	N

			Existing Effective Clearance(1)			Effective Vertical Clearance with OCS (2)		Lower than Existing Effective Clearance?
Milepost	Bridge	TRA Clearance (CL)	Effective Clearance Over CL	Existing Freight Heights	Allowable Plate Height / Plate (3)	Effective Clearance Over CL	Allowable Plate Height / Plate (3)	(Y/N)
4.27	Tunnel 4	21.08 (MT-1) 21.08 (MT-2)	20.20 (MT-1) 20.10 (MT-2)	17.08 / F	17.08 / F	18.00 (MT-1) 18.00 (MT-2)	17.08 / F (5)	N
5.10	Signal Bridge	N/A	23.17 (MT-1) 23.08 (MT-2) 23.33 (MT-3) 23.24 (MT-4) 23.60 (Lead Track)	18.92 / > F	20.25 / H	21.13 (MT-1) 21.04 (MT-2) 21.29 (MT-3) 21.20 (MT-4) 21.56 (Lead Track)	18.92 / >F (6)	Y
5.48	Signal Bridge	N/A	28.18 (MT-1) 28.36 (MT-2) 28.20 (MT-3) 28.52 (MT-4)	18.92 / > F	20.25 / H	26.14 (MT-1) 26.32 (MT-2) 26.16 (MT-3) 26.48 (MT-4)	18.92 / >F (6)	Y
5.83	Signal Bridge	N/A	27.36 (MT-1) 27.42 (MT-2) 27.55 (MT-3) 27.57 (MT-4) 27.57 (Lead track)	18.92 / > F	20.25 / H	25.32 (MT-1) 25.38 (MT-2) 25.51 (MT-3) 25.53 (MT-4) 25.53 (Lead Track)	18.92 / >F (6)	Y
6.29	Signal Bridge	N/A	27.68 (MT-1) 27.61 (MT-2) 27.90 (MT-3) 27.87 (MT-4) 28.06 (Lead track)	18.92 / > F	20.25 / H	25.64 (MT-1) 25.57 (MT-2) 25.86 (MT-3) 25.83 (MT-4) 26.02 (Lead Track)	18.92 / >F (6)	Y
6.95	Signal Bridge	N/A	28.10 (MT-1) 28.03 (MT-2) 27.91 (MT-3) 28.01 (MT-4)	18.92 / > F	20.25 / H	26.06 (MT-1) 25.99 (MT-2) 25.87 (MT-3) 25.97 (MT-4)	18.92 / >F (6)	Y

			Existing Effective Clearance(1)			Effective Vertical Clearance with OCS (2)		Lower than Existing Effective Clearance?
Milepost	Bridge	TRA Clearance (CL)	Effective Clearance Over CL	Existing Freight Heights	Allowable Plate Height / Plate (3)	Effective Clearance Over CL	Allowable Plate Height / Plate (3)	(Y/N)
8.24	Signal Cantilever	N/A	28.09 (MT-1) 27.94 (MT-2)	18.92 / > F	20.25 / H	26.05 (MT-1) 25.90 (MT-2)	18.92 / >F (6)	Y
8.60	Oyster Point Parkway	N/A	22.19	18.92 / > F	20.25 / H	20.15	18.92 / >F (6)	Y
9.10	Signal Bridge	N/A	21.59 (MT-1) 21.64 (MT-2)	18.92 / > F	20.25 / H	19.55 (MT-1) 19.60 (MT-2)	18.92 / >F (6)	Y
13.71	Signal Bridge	N/A	29.15 (MT-1) 29.10 (MT-2) 29.02 (MT-3)	18.92 / > F	20.25 / H	27.11 (MT-1) 27.06 (MT-2) 26.98 (MT-3)	18.92 / >F (6)	Y
14.14	Signal Bridge	N/A	28.32 (MT-1) 28.40 (MT-2) 28.20 (MT-3)	18.92 / > F	20.25 / H	26.28 (MT-1) 26.36 (MT-2) 26.16 (MT-3)	18.92 / >F (6)	Y
26.20	Signal Bridge	N/A	28.08 (MT-1) 28.06 (MT-2) 28.09 (MT-3)	18.92 / > F	20.25 / H	26.04 (MT-1) 26.02 (MT-2) 26.05 (MT-3)	18.92 / >F (6)	Y
26.35	Signal Cantilever	N/A	27.74 (MT-2) 27.62 (MT-4)	18.92 / > F	20.25 / H	25.70 (MT-2) 25.58 (MT-4)	18.92 / >F (6)	Y
27.12	Signal Bridge	N/A	27.60 (MT-1) 27.62 (MT-2) 27.58 (MT-3) 27.70 (MT-4)	18.92 / > F	20.25 / H	25.56 (MT-1) 25.58 (MT-2) 25.54 (MT-3) 25.66 (MT-4)	18.92 / >F (6)	Y
29.69	San Francisquito	21.75	21.05	18.92 / > F	20.25 / H	19.11	18.92 / >F	Y
34.00	San Antonio Ave.	N/A	22.14	18.92 / > F	20.25 / H	19.62	18.92 / >F (6)	Y
36.50	Hwy 85	N/A	22.14	18.92 / > F	20.25 / H	20.10	18.92 / >F (6)	Y
36.88	Whisman Rd.	N/A	22.47	18.92 / > F	20.25 / H	20.43	18.92 / >F (6)	Y

			Existing Effective Clearance(1)			Effective Vertical Clearance with OCS (2)		Lower than Existing Effective Clearance?
Milepost	Bridge	TRA Clearance (CL)	Effective Clearance Over CL	Existing Freight Heights	Allowable Plate Height / Plate (3)	Effective Clearance Over CL	Allowable Plate Height / Plate (3)	(Y/N)
38.60	Mathilda Ae.	N/A	22.37	18.92 / > F	20.25 / H	20.33	18.92 / >F (6)	Y
39.40	Pedestrian Overpass	N/A	21.85	18.92 / > F	20.25 / H	19.81	18.92 / >F (6)	Y
39.46	Signal Bridge	N/A	27.86 (MT-1) 27.75 (MT-2) 27.93 (MT-3) 27.71 (MT-4)	18.92 / > F	20.25 / H	25.82 (MT-1) 25.71 (MT-2) 25.89 (MT-3) 25.67 (MT-4)	18.92 / >F (6)	Y
40.14	Signal Bridge	N/A	29.28 (MT-1) 29.22 (MT-2) 29.38 (MT-3) 29.44 (MT-4)	18.92 / > F	20.25 / H	27.24 (MT-1) 27.18 (MT-2) 27.34 (MT-3) 27.40 (MT-4)	18.92 / >F (6)	Y
40.75	Lawrence Expressway	N/A	22.13	18.92 / > F	20.25 / H	20.09	18.92 / >F (6)	Y
40.90	Signal Bridge	N/A	27.17 (MT-1) 27.15 (MT-2) 27.29 (MT-3) 27.24 (MT-4)	18.92 / > F	20.25 / H	25.13 (MT-1) 25.11 (MT-2) 25.25 (MT-3) 25.20 (MT-4)	18.92 / >F (6)	Y
41.51	Signal Bridge	N/A	27.82 (MT-1) 27.80 (MT-2) 27.81 (MT-3) 27.91 (MT-4)	18.92 / > F	20.25 / H	25.78 (MT-1) 25.76 (MT-2) 25.77 (MT-3) 25.87 (MT-4)	20.25 / H	N
42.50	San Tomas Expressway	N/A	22.37	18.92 / > F	20.25 / H	21.33	20.25 / H	N
43.65	Lafayette Pedestrian Overpass	N/A	22.25	18.92 / > F	20.25 / H	20.21	18.92 / >F	Y
45.90	I-880	N/A	22.46	20.25 / H	20.25 / H	20.42	20.25 / H	N
46.15	Hedding Ave.	N/A	22.07	20.25 / H	20.25 / H	20.25	20.25 / H (7)	N

			Existing Effective Clearance(1)			Effective Vertical Clearance with OCS (2)		Lower than Existing Effective Clearance?
Milepost	Bridge	TRA Clearance (CL)	Effective Clearance Over CL	Existing Freight Heights	Allowable Plate Height / Plate (3)	Effective Clearance Over CL	Allowable Plate Height / Plate (3)	(Y/N)
46.34	Signal Cantilever	N/A	24.06 (MT-2)	20.25 / H	20.25 / H	22.02 (MT-2)	20.25 / H	N
46.50	Signal Cantilever	N/A	27.23 (MT-2) 27.50 (MT-3)	20.25 / H	20.25 / H	25.19 (MT-2) 25.46 (MT-3)	20.25 / H	N
47.0	Cahill Station	15.67	Structure does not exist	20.25 / H	20.25 / H	N/A	N/A	N
47.05	Signal Bridge	N/A	27.88 (MT-2) 28.05 (MT-3) 28.13 (Lead Track)	20.25 / H	20.25 / H	25.84 (MT-2) 26.01 (MT-3) 26.09 (Lead Track)	20.25 / H	N
47.30	Signal Bridge	N/A	23.56 (MT-2) 23.44 (MT-3)	20.25 / H	20.25 / H	21.52 (MT-2) 21.40 (MT-3)	20.25 / H	N
47.89	San Carlos Ave.	22.17	21.53	20.25 / H	20.25 / H	20.25	20.25 / H (7)	N
49.13	Signal Cantilever	N/A	23.08 (MT-2)	20.25 / H	20.25 / H	21.04 (MT-2)	20.25 / H	N
50.55	Signal Cantilever	N/A	27.76 (MT-2)	20.25 / H	20.25 / H	25.72 (MT-2)	20.25 / H	N
50.59	Curtner Ave.	N/A	21.99	20.25 / H	20.25 / H	20.25	20.25 / H (7)	N
50.65	Signal Cantilever	N/A	27.72 (MT-2)	20.25 / H	20.25 / H	25.68 (MT-2)	20.25 / H	N
51.08	Private Overpass	N/A	21.96	20.25 / H	20.25 / H	20.25	20.25 / H	N
51.64	Signal Cantilever	N/A	25.24 (MT-2)	20.25 / H	20.25 / H	23.20 (MT-2)	20.25 / H	N

Milepost	Bridge	TRA Clearance (CL)	Existing Effective Clearance(1)			Effective Vertical Clearance with OCS (2)		Lower than Existing Effective Clearance?
			Effective Clearance Over CL	Existing Freight Heights	Allowable Plate Height / Plate (3)	Effective Clearance Over CL	Allowable Plate Height / Plate (3)	(Y/N)

Notes:

Existing effective clearance is defined as the existing clearance measured over the centerline of the track minus 6 inches of dynamic envelope per Caltrain Standards

Effective vertical clearance with OCS is defined as existing clearance measured over the centerline of the track minus 1.5 feet of OCS structure depth and 1.04 feet of electrical clearance envelope. Includes Proposed Project notching/lowering at several tunnels and track lowering at 4 underpasses (see Section 3.14)

Allowable Plate Height / Plate takes into account for clearance restrictions downstream. Allowable Plate Height / Plate at tunnels are not constrained by measurement over center line of track but by the tunnel walls. Plate Heights are as defined by AAR: Plate C = 15.50'; Plate F = 17.08'; Plate H = 20.25'. Due to the shape of the tunnels, a vehicle with a height greater than Plate C, 15.50' can clear through the tunnels depending on the width of the vehicle.

Effective vertical clearance North of Tunnel 3 is constrained by Tunnels 1 and 2. Design considerations from the project will maintain clearance for a Plate C

Effective vertical clearance from Bayshore to the Quint Street Lead to the Port of SF is constrained by Tunnels 3 and 4. Design considerations from the project will maintain clearance for a Plate F.

Effective vertical clearance from Bayshore to the Butterhouse Spur at MP 41.4 restricted to 18.92' due to San Francisquito Bridge clearance. Actual physical clearance with OCS may be higher than effective clearance.

Project design to provide Plate H clearance.

Analysis assumes that MT-1 South of CP Coast at MP 44.0 (MP 43.4) is not electrified and thus there's no change to existing MT-1 clearance or impact to freight traffic South of CP Coast.

1

The potential restriction of the ability to utilize higher freight trains would most likely result in the continued use of freight equipment similar to that used at present which would conform to the clearances provided with the Proposed Project. This could potentially mean reliance on longer trains using lower cars for future expanded freight service. Alternatively, freight could be diverted to other modes (such as truck) or to other destinations (such as the Port of Oakland or Port of Richmond).

At present, approximately three round-trip freight trains operate in this part of the Caltrain corridor. ~~and,~~ This could increase to perhaps four round-trip trains by 2020[29] and as shown in Table 4-8 perhaps six round-trip freight trains by 2040. Since the existing freight can be accommodated by the Proposed Project, the maximum potential diversion to other modes would be three round-trip freight trains by 2040. It is probable that the additional trains would just use lower train cars similar to existing freight trains and no diversion would occur due to changes in height. The South City Local would likely not be affected because tunnel heights already heavily constrain potential equipment and the Proposed Project would accommodate existing freight heights. It is also likely that any additional mid-Peninsula freight moves could also be accommodated by using freight equipment similar to existing freight equipment. Thus, a base case was analyzed assuming that the freight associated with one future daily round-trip train from South San Francisco to San Jose might be diverted to trucks because of Proposed Project height changes with the OCS in 2020. A more extreme case of diverting all new freight (three daily round trips over existing freight levels) to trucks was also analyzed for 2040.

Analysis of Environmental Effects due to Potential Diversion of Small Amounts of Freight from Rail to Trucks

Business effects by themselves would not be considered environmental impacts, unless somehow the change in train operations would result in secondary physical environmental impacts. Such effects would only occur if there was a diversion of freight from rail to trucks (or other modes) which would then result in secondary environmental impacts such as additional traffic, noise, criteria pollutant emissions or GHG emissions compared with rail freight operations, which are discussed below.

Traffic

If the freight associated with one additional South San Francisco–San Jose freight train with 50 loaded cars were diverted to trucks (assuming 100 tons of cargo per railcar), then the approximately 5,000 tons of freight would need to be carried by 200 to 250 trucks. Assuming an 80 mile round trip for trucks, the additional regional miles would be 16,000 to 20,000 miles.

As discussed in Section 3.14, *Transportation and Traffic,* and this section, the Proposed Project would lower Regional VMT by 235,000 miles in 2020 and 619,000 miles in 2040 (with Caltrain Full Electrification) compared with No Project conditions. The VMT reduction would particularly benefit traffic congestion on major arterials and freeways used for longer-distance commutes. The resulting reduction in regional VMT emissions would be vastly larger than the potential increased truck traffic if the freight from the one example daily freight train from South San Francisco to San Jose were diverted to trucks. This conclusion would hold even if the amount of diverted freight daily consisted

[29] The cumulative growth in freight for Table 4-8 was assumed to be 4 percent per year. At this rate, by 2020, freight could increase from 3 to 4 round-trip trains on the Redwood City to San Francisco segment.

of all three new daily trains. As a result, the diversion of limited amounts of freight from train to truck is not identified as a significant cumulative regional traffic impact as the positive regional traffic benefits of the Proposed Project would vastly outweigh the likely regional traffic effects of potential diversion of small amounts of freight traffic.

However, the diversion of freight from one round trip train to truck could result in 200 to 250 additional truck trips per weekday along the congested San Francisco Peninsula by 2020. Diversion of freight from three round trip trains would add 600 to 750 truck trips per weekday by 2040. Without knowing specific routing and timing, it is difficult to make conclusions about the impact on traffic congestion. Where truck routing is during peak hours on localized intersections with failing conditions that the Proposed Project does not benefit, additional truck traffic potentially diverted from the Caltrain corridor could contribute to significant cumulative localized traffic impacts.

Noise

For noise, there is a tradeoff between freight train noise along the Caltrain ROW and truck noise along truck haul routes. While train noise would be lowered along the Caltrain corridor, truck noise would be increased along haul routes. Existing freight train noise crosses through a mix of residential, commercial, and industrial areas along the Caltrain corridor between San Jose and San Francisco. Without knowing specific truck routing and timing (day or night), it is difficult to make site-specific conclusions about the sensitive receptors affected by potentially increased truck traffic. Regionally, the diversion of freight to trucks is unlikely to result in substantial increase in the number of sensitive receptors along truck haul routes compared with the relatively high number of sensitive receptors affected by freight noise along the Caltrain corridor already. However, it is possible that there may be localized noise increased due to diverted freight truck traffic and, thus, that diverted truck hauling could contribute to potential cumulative noise along new truck haul routes.

Air Quality

Freight trains are considered more efficient than trucks for long-hauling of materials and thus result in less overall criteria pollutant emissions on a ton-mile basis. For example, a recent study of increasing freight rail transport for goods from the Salinas Valley concluded that criteria pollutants could be reduced by 12 to 45 percent (depending on the pollutant) compared with current hauling by truck (Transystems 2011). The EPA has noted that, on a ton-mile basis, trains are 2 to 4 times more fuel efficient and have one-half to one-third the NOx emissions compared with trucks (USEPA 2010). One comparison of trains vs. trucks described that railroads carry 455 ton-miles/gallon of diesel vs. 105 ton-miles/gallon of diesel for trucks (Brown and Hatch 2002).

As an example, the additional freight train trip per day carrying 5,000 tons (50 loaded cars) one-way from San Francisco to San Jose (distance of 37 miles/185,000 ton-miles) could not be accommodated, the daily increase due to truck emissions was estimated as approximately 102 ~~101~~ to 204 ~~202~~ pounds (lbs) of NO_X (using EPA assumptions noted above) which would easily exceed the BAAQMD's daily threshold of 54 lbs/day for NOx. [30]

As discussed in Section 3.2, *Air Quality*, the Proposed Project would lower NOx emissions by 566~~2,400~~ lbs/day in 2020 and 1,400 ~~1,600~~ lbs/day in 2040 (with Caltrain Full Electrification) compared with No Project conditions. This reduction in NO_X emissions would be ~~vastly~~ larger than

[30] Calculations are provided in Appendix B, *Air Quality and Greenhouse Gas Analysis Technical Data*.

the potential increased NO_X emissions if the example daily freight trip from South San Francisco to San Jose were diverted to trucks for 2020. For 2040, this conclusion would hold even if the amount of freight diverted daily were two to three times larger than estimated above for the single daily trip. In addition, as noted above, freight will continue to be able to use freight equipment of the same heights as at present, and thus the likelihood of substantial diversion of freight to trucks is considered very low. As a result, no significant cumulative impact to air quality is identified due to the potential diversion of limited amounts of train freight to trucks.

Greenhouse Gas Emissions

As noted above, freight trains are considered more efficient than trucks for long-hauling of materials and thus result in less overall greenhouse gas emissions on a ton-mile basis. For example, the recent study of increasing freight rail transport for goods from the Salinas Valley cited above also concluded that greenhouse gas emissions could be reduced by 59 percent compared with current hauling by truck (Transystems 2011). The EPA has also noted that, on a ton-mile basis, trains emit one-third the GHG emissions of trucks (USEPA 2010).

If the example daily haul trip (described above for the air quality analysis) was diverted daily for a period of over one year in 2020, annual GHG emissions (using EPA estimate of one-third GHG emissions for freight rail vs. trucks and assuming 260 days/year) would increase by approximately 2,500 metric tons of CO2e (MT CO_2e) per year due to diversion from freight rail to trucks.[31]

As discussed in Section 3.6, *Greenhouse Gas Emissions and Climate Change*, the Proposed Project would lower annual GHG emissions by approximately 79,000 ~~68,000~~ MT CO2e /year in 2020 and 189,000 ~~177,000~~ MT CO2e/year in 2040 (with full Caltrain electrification) compared with No Project conditions. This reduction in GHG emissions would be vastly larger than the potential increased GHG emissions if the example daily trip from South San Francisco to San Jose were diverted to trucks. This conclusion would hold even if the amount of freight diverted daily were two to three times larger than estimated above by 2040. As a result, ~~although adverse,~~ no significant cumulative impact to greenhouse gas emissions is identified due to the potential diversion of limited amounts of train freight to trucks.

Conclusion

As described above, the actual potential for diversion of freight is considered low and the low levels of existing and future freight can likely be accommodated even with ~~more constrained operational windows and~~ the changes in heights due to the Proposed Project OCS. Even if limited diversion of freight from trains occurs, it is not likely to result in significant secondary regional traffic, air quality or greenhouse gas emissions impacts because of the positive effects of the Proposed Project.

However, there is the potential for localized noise and traffic effects as a result of diverting some future increases in freight carried by rail to trucks because of changes in the ~~operational window or~~ lowered vertical height due to the OCS. This is considered a potentially significant cumulative impact on localized noise and localized traffic.

~~Relative to operational windows, the FRA waiver requirements for temporal separation are not under the control of Caltrain. Constraining operational windows for Caltrain and other passenger railroads to allow for untrammeled freight access from 8 p.m. to 5 a.m. would be counterproductive~~

[31] Calculations are provided in Appendix B, *Air Quality and Greenhouse Gas Analysis Technical Data*.

~~to the Proposed Project's purpose of expanding passenger rail service and would only result in additional air quality and greenhouse gas emissions and regional traffic. Thus, impacts associated with smaller operational windows relative to future potential freight increases is considered cumulatively significant and unavoidable.~~

To manage the potential constraint on future freight hauling along the Caltrain corridor due to lowered vertical clearances, Mitigation Measure TRA-CUMUL-3 is proposed. ~~With implementation of this mitigation, freight hauling heights would not be limited by installation of the OCS.~~

Caltrain evaluated the feasibility of providing additional vertical clearance at the San Francisquito bridge. Due to the nature of the existing truss structure, gains in vertical clearance could only be made by rebuilding the existing bridge. San Francisquito Bridge is a historic bridge and rebuilding or replacing the bridge would result in the loss of its historic character. Costs would be an estimated $48 million with a project duration of 6.5 years). Construction would require disruption to both passenger and freight rail unless a temporary bridge were built. Construction of a temporary bridge and/or replacement of the existing bridge would disturb San Francisquito Creek which is habitat for listed steelhead and California red-legged frog. Construction would not be allowed to use access from the east side of the ROW due to the presence of the "El Palo Alto" redwood tree. Disturbance on the west side would result in disturbance of riparian vegetation. Despite the cost and environmental damage, replacement of the bridge would only result in a minimal gain in vertical clearance (from 19' to 20.25'). Existing freight Santa Clara to Bayshore only uses 18.92' height freight cars at present and there is no reason that additional trains in the future could not use the same equipment to serve customers along the Corridor. Given the cost and environmental impact and the minimal height gain, Caltrain does not propose to rebuild this bridge as part of Mitigation Measure TRA-CUMUL-3.

An alternative approach to the San Francisquito Bridge vertical clearance would be to provide a short "neutral section" in which the OCS would have a non-electrified segment through the bridge. This approach has been used for several short areas of electrified railroads in the UK in areas of constrained overhead clearance, but has only been recommended for low speed, low frequency branch lines (Network Rail 2013, Network RUS Alternative Solutions). Mitigation Measure TRA-CUMUL-3 requires assessment of the feasibility of a neutral section for the San Francisquito Bridge location. If a neutral section is feasible while supporting project service objectives and safety, then Mitigation Measure TRA-CUMUL-3 would require the use of neutral section at the San Francisquito Bridge location as necessary to accommodate actual freight use of Plate H equipment north of Santa Clara (as noted previously, at present freight operators are not using Plate H equipment north of San Jose).

However, if a neutral section is not feasible at San Francisquito Bridge, freight heights from Bayshore (MP 5.5) to the Butterhouse Spur (MP 41.4) would be limited to 18.92' (Plate F+) which is the height of current equipment, but is less than the existing effective clearance on this segment of approximately 20.25' (Plate H). There are no freight spurs from the San Francisquito Bridge (MP 29.7) to the Butterhouse Spur (MP 41.4), so Mitigation Measure TRA-CUMUL-3 only includes improvements south of the Butterhouse Spur if a neutral section is not feasible at the San Francisquito Bridge.

Thus, with Mitigation Measure TRA-CUMUL-3, vertical clearances from the south end of the project (MP 52.0) to the Butterhouse Spur (MP 41.4) would allow Plate H equipment similar to today's existing effective conditions. If Plate H clearance cannot be provided at the San Francisquito Bridge through use of a neutral section, from the Butterhouse Spur to Bayshore, Plate F+ (18.92')

equipment could be used the same as under today's operations, but Plate H equipment could not be used. North of Bayshore, the project's proposed tunnel improvements would provide the same effective vertical clearance as present, and no additional tunnel improvements are included as mitigation.

If Plate H clearance cannot be provided at the San Francisquito Creek Bridge through use of a neutral section, Mitigation Measure TRA-CUMUL-3 would be limited to track lowering at the Lafayette Pedestrian Overpass (MP 43.65) to provide Plate H clearance to allow Plate H clearance to be able to access the Butterhouse Spur.

The residual cumulative impact would be a future constraint on train equipment to existing freight heights from the Butterhouse Spur to Bayshore to Plate F+ (18.92') instead of the current possible Plate H (20.25') clearance. While it is not likely that freight will be diverted to truck modes due to this change, given that existing Plate H equipment is not used on this portion of the corridor, it is possible there might be a mode shift for some of the future freight growth. As discussed above, this would not be a significant regional traffic, air quality or GHG emissions cumulative impact, but might result in some localized noise or traffic impacts, depending on location of truck haul routes, timing, and intensity. This is considered a significant and unavoidable impact, primarily due to the concerns described above concerning the San Francisquito Bridge.~~As noted in Mitigation Measure TRA-CUMUL-3, additional site improvements may be necessary in the future to accommodate higher freight heights. Potential additional track lowering and minor notching improvements would likely have similar effects to the Proposed Project's minor notching/track lowering activities at three tunnel and bridge locations.~~

However, if Plate H clearance can be provided at the San Francisquito Bridge through use of a neutral section, then Mitigation Measure TRA-CUMUL-3 would require track lowering and/or neutral sections (if feasible) at additional locations to allow Plate H equipment operation from San Jose to Bayshore. In this scenario, Plate H clearance would be provided from San Jose to Bayshore, similar to that available today (but not utilized) and there would not be a potential for shift of freight from rail to truck modes and this impact would be mitigated to a less than significant level.

~~However, potential modifications for this mitigation could be more extensive than those included in the Proposed Project and may or may not be feasible. For example, while track lowering and complete rebuild of the tunnel portals are technically feasible to rectify potential tunnel impediments, these solutions are costly and would results in major disruptions to existing operations and to the character of the San Francisco tunnels, which are historic resources. Similarly, modification at other historic bridges or underpasses, such as the San Francisquito Creek bridge, could result in greater impacts related to cultural resources than under the Proposed Project. Given that potential future modifications are not defined at this time, secondary physical impacts are considered potentially significant and unavoidable.~~

Mitigation Measure TRA-CUMUL-3: As warranted, Caltrain and freight operators will partner to provide Plate H clearance as feasible between San Jose and Bayshore ~~site improvements to restore existing effective vertical height clearances along the Caltrain corridor.~~

Caltrain and freight operators share responsibility for the potential constraints that may occur due to the combination of a change in freight operating equipment and the installation of the OCS.

Bayshore to Butterhouse Spur (MP 41.4)

If freight operators identify a plan to operate freight railcars along the Caltrain corridor between Bayshore and the Butterhouse Spur (MP 41.4) that would be hindered by the OCS installation compared with existing conditions, then Caltrain and freight operators shall evaluate the feasibility to provide Plate H effective vertical height clearances where needed along this segment of the Caltrain corridor.

The evaluation shall first include a feasibility assessment of a "neutral section", or unelectrified segment, for the San Francisquito Bridge. If the use of a "neutral section" is feasible without compromising project service improvement objectives or safety, then a combination of track lowering and "neutral sections" (if feasible) shall be used to provide Plate H clearance between Bayshore and the Butterhouse Spur (MP 41.4).

Based on current analysis (see Table 4-23) apart from San Francisquito Bridge, additional vertical clearance height would be required at the following locations to support Plate H equipment: Oyster Point Parkway (MP 8.60, +0.1'), Signal Bridge (MP 9.10, +0.7'), San Antonio Avenue (MP 34.0, +0.63'), Highway 85 (MP 36.5, +0.15'), Pedestrian Overpass (MP 39.40, +0.44') and Lawrence Expressway (MP 40.75, +.16').

If a "neutral section" is not feasible at the San Francisquito Bridge and thus the entire segment would be constrained by the low point at the San Francisquito Bridge, then no further improvements are required between Bayshore and the Butterhouse Spur.

Butterhouse Spur (MP 41.4) to MP 52.0

If freight operators identify a plan to operate freight railcars along the Caltrain corridor between MP 52.0 and the Butterhouse Spur (MP 41.4) that would be hindered by the OCS installation compared with existing conditions, then Caltrain and freight operators shall implement site improvements to restore effective vertical height clearances where needed along the Caltrain corridor.

Based on current analysis, the only proposed improvement in addition to the Proposed Project tunnel notching/track lowering at the four San Francisco tunnels and the track lowering at Hedding Avenue (MP 46.15), San Carlos Avenue (MP 47.89), Curtner Avenue (MP 50.59), a private overpass (MP 51.08), would be track lowering at the Lafayette Pedestrian Overpass (MP 43.65).

~~Possible solutions to rectify the reduction in existing clearance at the tunnels can include deeper notching, track lowering, combination of notching and track lowering, or a complete rebuild of the tunnel portal. Probing of tunnel lining will determine the existing condition of tunnel linings and the necessary solution to rectify the impediments.~~

Both Segments

Track lowering is a possible solution to rectify the reduction in clearance at constrained bridge overcrossings, but further study will be required to determine the condition of track subgrade in each specific area and to locate existing utilities that may impact the track lowering. If it is determined existing utilities are in the way of potential track lowering, the existing utilities will have to be relocated in order to achieve the desired clearance.

~~This mitigation is limited to site improvements designed to restore existing effective vertical clearance only. The effective vertical clearance shall be defined not only by the individual vertical clearance at a particular constraint point, but also by the constraints along the corridor leading to that constraint point. For example, Tunnel 4 today has lower clearances than Tunnel 2 or Tunnel 3 and effectively limits the height of trains that can transit through Tunnels 2 through 4. This mitigation is limited to restoring effective vertical clearance that can actually be used taking into account all constraints along the corridor.~~

Caltrain and the freight operators shall apportion any cost pursuant to the existing agreement between the parties.

Presuming that any identified improvements will be implemented by an entity that is subject to CEQA, those improvements would need to be analyzed for their environmental impacts, as warranted, to determine if any additional significant impacts beyond those disclosed in this EIR for clearance improvements (e.g., those described in Chapter 2, *Project Description*). Environmental clearance shall be obtained, if necessary and required, prior to construction of any additional site improvements.

All relevant mitigation included in this EIR would apply to any additional construction necessary to implement this mitigation measure.

4.2 Significant and Unavoidable Environmental Impacts

Impacts related to the following topics would remain significant and unavoidable with the implementation of mitigation.

- Construction
  - Cultural Resources – As described in Section 3.2, *Cultural Resources*, due to tunnel modifications necessary to provide heights for Caltrain and freight rail cars, the modifications to historic San Francisco Tunnel 4 may be significant and unavoidable even with mitigation.
  - Noise—As described in Section 3.11*, Noise and Vibration*, although project mitigation would reduce noise in many locations, given nighttime construction it may not always be possible to reduce construction noise to a less-than-significant level.
- Operations
  - Aesthetics—As described in Section 3.1*, Aesthetics,* although project mitigation would reduce tree removal/trimming effects in many locations, it may not always be possible to replace trees in locations that would avoid significant changes in localized visual character at individual parcels affected by tree removal/pruning. As described in Section 4.1, *Cumulative Impacts*, the Proposed Project would also contribute considerably to cumulative effects on local visual character, relative to tree removals/pruning.
  - Hydrology and Water Quality - As described in Section 3.9, *Hydrology and Water Quality*, the Caltrain ROW, including new Proposed Project facilities may be subject to future flooding associated with sea level rise. Although project mitigation may be able to reduce the potential impacts of future flooding on the Proposed Project, given that effective coastal flooding mitigation requires the involvement of multiple parties beyond Caltrain, at this

time it cannot be concluded that future flooding impacts to the Caltrain system will be fully avoided. As described in Section 4.1, *Cumulative Impacts*, this would also be considered a potential considerable contribution to a significant cumulative impact. As described in Section 3.9, *Hydrology and Water Quality,* given the *Ballona Wetlands* decision, it is unknown whether or not the impacts of sea level rise on a project are properly considered significant impacts under CEQA and thus this EIR discloses this impact for disclosure purposes in case they are.

- Noise—As described in Section 4.1, *Cumulative Impacts*, with cumulative passenger and freight rail increases along the Caltrain corridor there would be significant noise increases affecting sensitive receptors. Where mitigation is not feasible to reduce the Proposed Project's noise contribution, the Proposed Project would also contribute to cumulative noise impacts at a number of locations.
- Transportation and Traffic: As described in Section 3.14, *Transportation and Traffic*, although project mitigation would reduce localized traffic impacts at a number of affected locations, it would not be feasible to reduce all localized traffic impacts with mitigation. As described in Section 4.1, *Cumulative Impacts*, the Proposed Project would also have a considerable contribution to a significant cumulative impact on localized traffic conditions, even with mitigation, and a potentially significant cumulative impact related to localized traffic and noise resulting from the diversion of limited amounts of freight from rail to truck modes (although diversion of freight to trucks is an unlikely impact).

4.3 Significant and Irreversible Environmental Changes

The Proposed Project would involve installation of OCS and TPFs along the 51-mile project corridor, which would require the use of materials such as steel and copper, as well as fossil fuels, during construction. The source metals used, unless they come from recycled materials, would represent an irreversible use of resources. Fossil fuels used during construction would also represent an irreversible use of oil and natural gas.

The Proposed Project also would require electrical energy to power the new EMUs. Section 4.5, *Energy*, documents the Proposed Project's energy consumption.

~~The Proposed Project would require electrical energy to power new EMUs. While the Proposed Project would use far more electricity than the present Caltrain system uses, the Proposed Project would use far less diesel fuel. When calculating the overall energy consumption (on a British Thermal Unit - BTU basis), the Proposed Project would consume far less energy directly than the current system does (see Table 4-20 below). The difference in energy consumption can be attributed to the relative efficiency of electric-powered vehicles and the relative inefficiency of diesel-powered vehicles.~~

The continued diesel use, albeit substantially lower with the Proposed Project, would continue use of non-renewable fossil fuels. To the extent that electricity supplying the Proposed Project comes from renewable sources (hydropower, sun, wind, geothermal), it would not represent an irreversible use of resources. To the extent that electricity supplying the Proposed Project comes from non-renewable sources (natural gas, coal, nuclear), it would represent an irreversible use of those resources.

Permanent visual alterations would result from the Proposed Project, comprising the introduction of poles and wires, and TPFs. Additionally, trees and mature vegetation would be removed and pruned. Some trees and vegetation would not be replaced on-site, resulting in a physical and aesthetic permanent change in certain locations. As documented in Section 3.1, *Aesthetics*, these physical changes would alter views from residential or business areas in various locations along the corridor, but they would not significantly obscure a scenic view or vista. However, even with mitigation, some local visual character would be permanently altered.

The Proposed Project would also introduce a new source of EMF along the project alignment. As detailed in Section 3.5, *Electromagnetic Fields and Electromagnetic Interference*, the Proposed Project would likely increase the level of EMF along the perimeter of the Caltrain ROW and at locations that passengers and workers frequent, such as passenger stations, on-board passenger coaches and locomotives, and at the perimeter of electrical substations. The EMF environment resulting from the Proposed Project would have field levels similar to those in the vicinity of moderate voltage utility transmission and distribution lines, but unlike the utility environment, the EMF fields from electrified Caltrain operations would be highest only during peak revenue operations, lessening during lower volume periods to become nominal during the late night when train service is discontinued and/or only line maintenance is proceeding. The field strengths are below ranges identified as levels of concern for human health effects. While the Proposed Project would permanently change the EMF field levels along the corridor as long as electrified trains utilized the corridor, this change is not irreversible. If a new preferable power source were identified in the future that replaced electrified service, then the EMF fields from the electrified service would be removed.

4.4 Growth-Inducing Impacts

CEQA requires a consideration of a project's capacity to induce growth.

Growth inducement would occur if the amount of population or employment growth projected to occur as a result of the Proposed Project would exceed planned levels. Increased development and growth in an area are dependent on a variety of factors, including employment and other opportunities, availability of developable land, and availability of infrastructure, water, and power resources.

A growth inducement analysis was conducted for the Proposed Project, as described in Section 3.12, *Population and Housing*. This analysis determined that the Proposed Project's changes in travel time savings would have little to no effect on the overall growth pressures in the project corridor because Caltrain serves only developed areas within a well-established rail corridor and the Proposed Project would not extend this corridor or provide access to undeveloped areas.

4.5 Energy

Under the Proposed Project, use of EMUs for approximately 75 percent of Caltrain's fleet for service between San Francisco and San Jose would require electrical energy to power the new EMUs and would increase electricity demand. Table 4-24 summarizes the annual direct energy consumption associated with the new EMUs under the Proposed Project by year 2020 and with full electrification in 2040 and compares this energy consumption to the existing Caltrain system and No Project

conditions for 2020 and 2040. The overall energy consumption is calculated on a British Thermal Unit (BTU) basis and accounts for both train operation and idling. Transmission and distribution loses for electricity are included in electricity totals as well as direct electricity consumption.

Table 4-24. Annual Direct Energy Consumption

Scenario	Train Fuel Use	Diesel (gallons)[a]	Electricity (kwh)	Direct Energy Use (million BTUs)[b]	Avoided VMT gallons/year	Net Direct Energy Use Million BTU (w/ VMT reduction)
Existing	All diesel with electricity for shore power at terminal	4,452,984	4,214,860	633,346	0	633,346
No Project (2020)	All diesel with electricity for shore power at terminals	5,599,784	4,214,860	792,751	0	792,751
Proposed Project (2020)	SF – SJ: 75% EMUs/ 25% Diesel Gilroy – SJ: 100% Diesel	1,073,711	88,817,309	452,290	-1,718,058	237,533
No Project (2040)	All diesel with electricity for shore power at terminals	5,725,108	4,214,860	810,171	0	810,171
Fully Electrified (2040)	SF – SJ: Electrified Gilroy – SJ: Diesel	146,615	112,027,827	402,618	-2,952,584	33,545

[a] Fuel use from Appendix B, *Air Quality and Greenhouse Gas Analysis Technical Data*.
[b] BTU factors from USEPA 2004: Diesel—139,000 BTU/gallon; Electricity—3,412 BTU/kwh.

While the Proposed Project would use far more electricity than the present Caltrain system, the Proposed Project would use far less diesel fuel. As stated in Section 3.13, *Public Services and Utilities*, the electricity use in 2040 would be approximately 0.5% of the total electricity demand in San Mateo and Santa Clara Counties.[32]

As shown in Table 4-24, the Proposed Project would consume substantially less energy directly than the current system does since it would replace diesel-powered vehicles with electric-powered vehicles. The difference in energy consumption can be attributed to the relative efficiency of electric-powered vehicles and the relative inefficiency of diesel-powered vehicles. The Proposed Project itself would represent an efficient transportation option as compared to the existing Caltrain system.

Overall, there would be no significant physical environmental impact associated with the Proposed Project's direct energy consumption, because the project would lower overall energy consumption.

[32] By way of comparison, the estimated annual electricity demand of the Facebook Menlo Park campus project would be 27 million kWh/year (City of Menlo Park 2011). The Apple Campus 2 project in Cupertino would have a projected electricity demand of 142 million kWh/year, but expects to supply the majority of this power from on-site photovoltaic and fuel cell systems with the remainder from off-site renewable energy direct access power (City of Cupertino 2012).

The project represents a lowering of energy use in the transportation sector compared to existing and No Project conditions and thus there is no need per Appendix F of the CEQA guidelines to consider alternatives with lower transportation energy use or to consider mitigation relative to transportation energy use.

The physical environmental impacts associated with the energy infrastructure system are described in Section 3.13, *Public Services and Utilities.* The Proposed Project's increase in electricity demand would be supported by the Pacific Gas and Electric (PG&E) existing transmission and generation system. Section 3.2, *Air Quality*, also describes the emissions associated with the Proposed Project's electricity consumption, whereby the Proposed Project emissions would be lower than the existing Caltrain system condition in both 2020 and 2040. The difference in emissions would be a direct result of the Proposed Project, which would consume less diesel fuel than the existing Caltrain system and would operate energy-efficient EMUs. Section 3.7, *Greenhouse Gas Emissions and Climate Change*, states that the Proposed Project would substantially reduce operational Caltrain system greenhouse gas emissions even with the increased electricity demand, as the electric vehicles would be more energy efficient than the diesel-powered vehicles. In both cases, the Proposed Project would introduce an environmental benefit relative to emissions.

Chapter 5
Alternatives

5.1 Introduction

CEQA requires that an EIR describe a range of reasonable alternatives to the project or to the location of the project that could feasibly avoid or lessen any significant environmental impacts while substantially attaining the basic objectives of the project. An EIR should also evaluate the comparative merits of the alternatives. This chapter analyzes the impacts of several alternatives in comparison with the potential environmental impacts associated with the Proposed Project, describes potential alternatives to the Proposed Project that were considered, and identifies alternatives that were eliminated from further consideration and reasons for dismissal.

Key provisions of the State CEQA Guidelines (Section 15126.6) pertaining to the alternatives analysis are summarized below.

- The discussion of alternatives will focus on alternatives to the project or its location that are capable of avoiding or substantially lessening any significant effects of the project, even if those alternatives would impede to some degree the attainment of the project objectives or be more costly.
- The no project alternative will be evaluated along with its impacts. The no project analysis will discuss the existing conditions at the time the notice of preparation was published as well as what would be reasonably expected to occur in the foreseeable future if the project were not approved based on current plans and consistent with available infrastructure and community services.
- The range of alternatives required in an EIR is governed by a "rule of reason"; therefore, the EIR must evaluate only those alternatives necessary to permit a reasoned choice. Alternatives will be limited to those that would avoid or substantially lessen any of the significant effects of the project.
- An EIR need not consider an alternative with effects that cannot be reasonably ascertained, when implementation is remote and speculative, and if its selection would not achieve the basic project objectives.
- The range of feasible alternatives is selected and discussed in a manner to foster meaningful public participation and informed decision making. Among the factors that may be taken into account when addressing the feasibility of alternatives, as described in State CEQA Section 15126.6(f)(1), are environmental impacts, site suitability, economic viability, social and political acceptability, technological capacity, availability of infrastructure, general plan consistency, regulatory limitations, jurisdictional boundaries, and whether the proponent could reasonably acquire, control, or otherwise have access to the alternative site.

5.2 Alternatives Considered for Further Analysis

As discussed below in Section 5.4, *Alternative Screening Process*, the JPB considered a wide range of alternatives suggested during the scoping process and then conducted a three-part screening evaluation to select the alternatives to be analyzed in this EIR. Alternatives determined to be infeasible, to not avoid or substantially reduce one or more significant impacts of the Proposed

Project, or to not meet all or most of the project's purpose and need were dismissed from further analysis. An additional alternative, the Tier 4 Diesel Locomotive Alternative was added for the Final EIR per comments on the DEIR.

Based on the screening process results, this EIR analyzes five ~~four~~ alternatives.

- No Project Alternative.
- Diesel Multiple Unit (DMU) Alternative.
- Dual-Mode Multiple Unit (MU) Alternative.
- Electrification with OCS Installation by Factory Train Alternative.
- Tier 4 Diesel Locomotive (T4DL) Alternative.

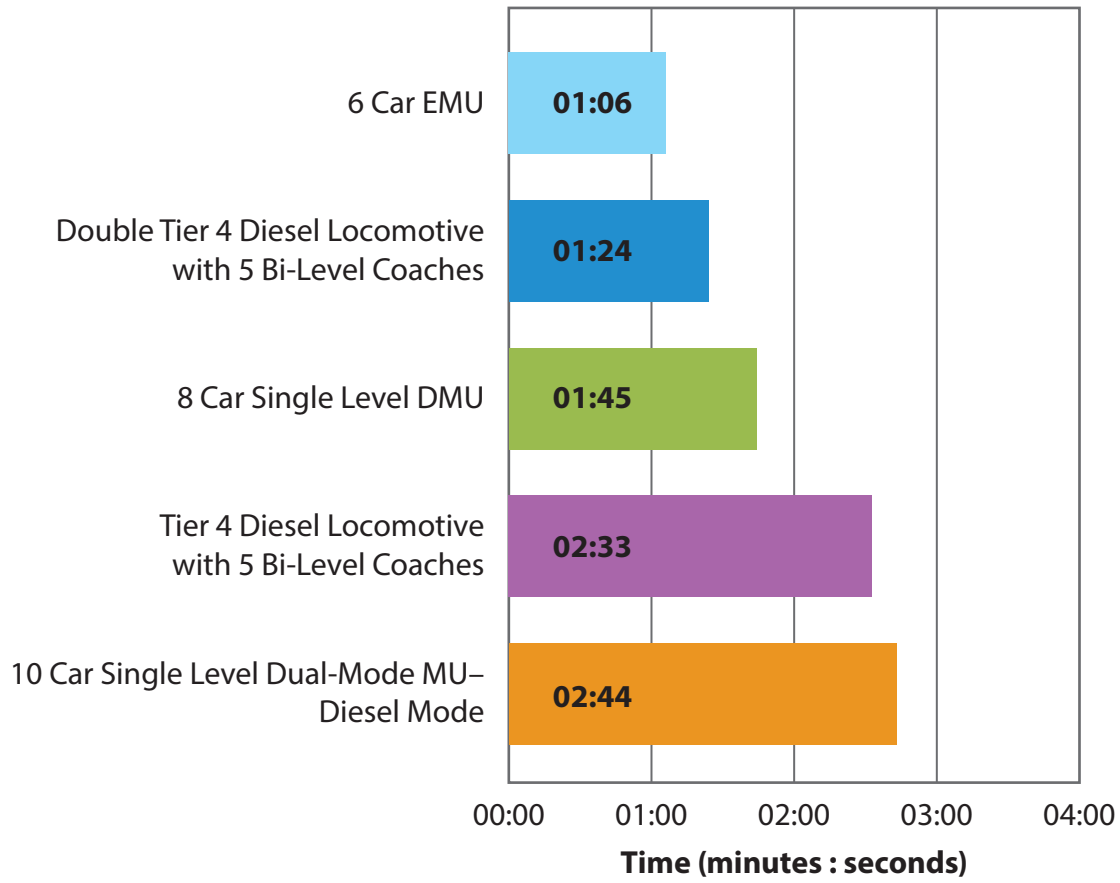
The Caltrain corridor includes many closely spaced stations. As a result, a key driver of train service is the ability to accelerate and decelerate quickly. Trains that can accelerate and decelerate quickly can be used to service more station stops, thus increasing ridership without compromising overall travel time. Because differences in ridership will result in differences in impacts on regional traffic, air quality and greenhouse gas emissions in this analysis, the comparative initial acceleration rates of the different alternatives and the Proposed Project are presented in Table 5-1.

Table 5-1. Estimated Initial Acceleration Rates of Different Alternatives and the Proposed Project

Operator	Diesel Locomotives (No Project)	Dual-Mode Multiple Units	Diesel Multiple Units	Tier 4 Diesel Locomotive (T4DL)	Electric Multiple Units (Proposed Project)
Initial Acceleration Rate (mph/sec)	0.5 (Existing) 1.1 (New)	~~1.1 (Diesel)~~ ~~1.5 (Electric)~~ 1.7 (both modes)	~~1.4~~ 1.8	1.1 (Single) 2.1 (Double)	2.1
Sources	Mass. EOT 2008 (Table 3.1) LTK 2014 (LTK-T4)	~~Railway Gazette 2007~~ Agility 2009	~~EOT 2008 (Table 3.1)~~ Stadler 2009	LTK 2014 (LTK-T4)	LTK 2012

Initial acceleration is not the only story. As a train continues to accelerate, the acceleration over the course of time begins to vary more widely between the EMU and the DMU, Dual-Mode MUs (in diesel mode) and single-diesel locomotives. A DMU or Dual-Mode MU (in diesel mode) acceleration rate will decrease over time, while an EMU will maintain a much more stable acceleration over time. Thus, the time it takes an EMU to reach maximum operating speed is much shorter when compared to a DMU or Dual-Mode MU (in diesel mode), even if their initial acceleration rates are comparable. For a single new Tier 4 diesel locomotives, the same would be true, but for train consists with two new Tier 4 diesel locomotives, then the acceleration could roughly match the EMUs. Figure 5-1 shows the comparative acceleration times to 79 mph of the different alternatives.

The Proposed Project EMUs have a nominal deceleration rate of 2.0 mphps. In general, any multiple unit train (EMU, DMU, or dual-mode MU) can achieve a deceleration rate in the range of the Proposed Project EMUs. This deceleration rate is possible due to the larger quantity of traction motors distributed throughout the train, and thus a higher contribution from dynamic braking is possible. In contrast, locomotives only have traction motors on the locomotive, and so dynamic braking contributes less to the overall brake rate. Therefore, deceleration rate is not necessarily a deciding factor between EMUs, DMUs, and dual-mode MUs. However, multiple unit trains have somewhat of an advantage over locomotive-hauled equipment (the No Project scenario and the T4DL Alternative) in terms of deceleration rate. The new T4DLs being manufactured by Siemens have a reported maximum braking rate of 1.8 mphps (Siemens 2013). This is the braking rate of the



Source: LTK 2014.

Graphics ... 0060.12 (11-20-2014)

Note: This is a new figure prepared for the Final EIR

Figure 5-1
Simulated Acceleration Times to 79 mph by Alternative
Peninsula Corridor Electrification Project

locomotive on its own and does not take into account the deceleration rate with full passenger coaches. It is also important to note that the type of braking equipment used in addition to dynamic braking (such as tread brakes, disc brakes, or track brakes) can affect the brake rate substantially on any of these vehicle types. Thus, the 2.0 mphps nominal brake rate used for EMUs is a reference point only, and could be affected by a number of different design factors.

Ridership modelling was complete for the No Project Alternative as well as the Proposed Project. No ridership modelling was done for the other alternatives. Qualitatively, the other alternatives will likely have lower ridership due to inferior performance compared to the Proposed Project. In order to provide a conservative analysis, it was assumed that the non-electrification alternatives would have the same ridership in 2020 as the Proposed Project. For 2040, The DMU, T4DL-SH and T4DL-DH alternatives would all assumed to have lower ridership as these alternatives cannot reach TTC. The Dual-Mode MU Alternative could reach TTC and thus, as a conservative assumption, it was assumed that this alternative would have the same ridership as the Proposed Project in 2040.

Table 5-2. Comparison of Ridership Estimates/Assumptions by Alternative

	No Project	Dual-Mode MU	DMU	T4DL (SH/DH)[1]	Proposed Project
2020 Modelled[2]	57,400	---	---	---	69,900
2020 Assumptions[3]	---	69,900	69,900	69,900	---
2040 Modelled[2]	83,900	---	---	---	111,100
2040 Assumptions[3]	---	111,100	105,700 – 111,100	105,700 to 111,100	---

Notes:

[1] SH = single-head = single locomotive; DH = double-head

[2] No Project and Project ridership based on ridership modelling using VTA regional model.

[3] Ridership adjusted for performance for inability to reach TTC (DMU Alternative and T4DL for 2040). Ridership scenario assuming same ridership as PCEP also included for all action alternatives. See Appendix K for specific assumptions.

The amount of rolling stock was also estimated for each alternative as shown in Table 5-3.

Table 5-3. Comparison of Assumed Rolling Stock by Alternative

	No Project[1]	Dual-Mode MUs[3]	DMUs[3]	T4DL (SH to DH) [1, 4]	Proposed Project[2]
2020 - new	16 T4DLs 73 coaches	160 Dual-Mode MUs	120 DMUs	18 (SH) to 35 (DH) T4DLs 88 coaches	96 EMUs
2020 - existing	3 F40s (1998), 6 MP36s (2003), 45 existing coaches [Same for all scenarios]				
Full Replacement	25 T4DLs 118 coaches	240 Dual-Mode MUs 6 T4DLs 31 coaches	180 DMUs 6 T4DLs 31 coaches	27 (SH) to 44 (DH) T4DLs 146 coaches	138 to 150 EMUs 6 T4DLs 31 coaches

Notes:

[1] No Project and T4 DL Alternative new locomotives estimated by LTK (2014).

[2] Project fleet estimated by Caltrain.

[3] Dual-Mode MUs and DMUs estimated by ICF based on passenger seat ratios compared to EMUs.

[4] Coaches for T4DL Alternative estimated by ICF by scaling trains/day (114 vs. 92 with No Project).

See Appendix K for assumptions for the sensitivity analysis for other alternatives.

Capital cost estimates were only prepared for the No Project and the Proposed Project. Fuel costs were estimated for all alternatives. Qualitative descriptions of other costs are noted for the action alternatives for the sake of comparison as shown in Table 5-4.

Table 5-4. 2020 Costs by Alternative ($million)

	No Project	Dual-Mode Multiple Units	Diesel Multiple Units	Tier 4 Diesel Locomotive (SH/DH)	Proposed Project
Rolling Stock	$318	Similar to Proposed Project	Similar to Proposed Project	Similar to Proposed Project	$524 to 576
Infrastructure	None	Cost of Extended Platforms	Costs of Extended Platforms	None	$950 to $958
Total Capital	***$318***	***N/A***	***N/A***	***N/A***	***$1,474 to 1,531***
Fuel Costs	$ 26	$ 32	$ 32	$ 31/$43	$ 13

Notes:

[1] The DTX would have overhead electric wires used by the Dual-Mode MUs and the EMUs, but their costs are included in DTX costs, not the PCEP.

Sources: See Appendix K.

5.2.1 The No Project Alternative

Section 15126.6 (e) of the State CEQA Guidelines requires the analysis of a No Project Alternative. The No Project analysis must discuss the existing condition as well as what would reasonably be expected to occur in the foreseeable future if the project were not approved. Section 15126.6(e)(3)(B) of the State CEQA Guidelines states the following.

> If the project is…a development project on an identifiable property, the "no project" alternative is the circumstance under which the project does not proceed. Here the discussion would compare the environmental effects of the property remaining in its existing state against environmental effects that would occur if the project were approved. If disapproval of the project under consideration would result in predictable actions by others, such as the proposal of some other project, this "no project" consequence should be discussed. In certain instances, the "no project" alternative means "no build," wherein the existing environmental setting is maintained. However, where failure to proceed with the project will not result in preservation of existing environmental conditions, the analysis should identify the practical result of the project's non-approval and not create and analyze a set of artificial assumptions that would be required to preserve the existing physical environment.

The No Project Alternative is neither required nor expected to meet the project's purpose and need or avoid or reduce any of the significant impacts associated with the project.

The No Project Alternative would include no electrification of the Caltrain ROW between San Jose and San Francisco, no purchase of electric multiple units (EMUs), and no increase in train service. The current train service is assumed to continue unchanged to 2020 and 2040. This service consists of five trains per peak hour, 92 trains per day, through use of diesel engine–hauled locomotive trains.

Because Caltrain's existing fleet is aging, the No Project Alternative would include replacement of roughly 75 percent of its existing rolling stock with 16 new T4DLs and 73 new passenger coaches. For this analysis, the new T4DLs were assumed to have the same characteristics as the T4DLs under construction by Siemens for Caltrans which would be 4200 horsepower diesels capable of acceleration up to 1.1 mphps and top speed of 125 mph (Siemens 2013). These diesel locomotives would be more powerful than Caltrain's current diesels which have lower acceleration, lower top speeds, and range from 3,200 to 3,600 horsepower. The remaining rolling stock of 9 diesel locomotives and 45 passenger coaches would continue to be used until they reached the end of their service life. In the long run, the No Project Alternative fleet would include 25 Tier 4 diesel locomotives and 118 passenger coaches. The length of trains would be the same as today, meaning a

single diesel locomotive would be hauling 5 passenger coaches with a nominal seating capacity of 620 seats.

While this alternative would not increase train service, ridership would still increase, similar to how ridership has been increasing in recent years, meaning that trains would have a higher occupancy average in the future. Under this alternative, like the Proposed Project, other Caltrain improvements (such as the Communications Based Overlay Signal System Positive Train Control [CBOSS PTC] project, other station improvements, and the South Terminal Project) described in Section 4.1.3.1, *Rail Projects Planned within the Caltrain Corridor*, would go forward, but Caltrain service itself would not increase.

Table 5-5 ~~5-2~~ shows the estimated daily boardings for Caltrain and other Peninsula transit systems with the Proposed Project and the No Project Alternative for 2020 and 2040.

Table 5-5 ~~5-2~~. Estimated Daily Ridership, Proposed Project and No Project Alternative

Operator	2013 Observed	2020 No Project	2020 Project	2040 No Project	2040 Project (& DTX/TTC)
Caltrain	47,100	57,400	69,900	83,900	111,100
BART	366,600	459,500	459,100	678,900	676,900
SamTrans Bus (Local and BRT)	39,800	73,400	75,800	103,200	100,000
VTA Light Rail	34,600	70,600	70,700	129,300	129,900
VTA Bus (Local and BRT)	103,100	165,600	167,100	246,100	247,100
MUNI Metro	173,500	203,800	205,200	252,200	250,100
MUNI Bus	531,700	592,600	595,500	736,600	740,200
Shuttles (Caltrain + Private)	NA	12,200	16,600	20,700	27,000
Total	**1,297,700**	**1,683,400**	**1,718,700**	**2,311,600**	**2,332,600**

Source: Appendix I, Ridership Technical Memorandum

As shown, Caltrain ridership is expected to increase with or without the Proposed Project, but would increase by approximately 22 percent with the Proposed Project compared with the No Project Alternative in 2020 and by approximately 32 percent by 2040 (including the Downtown Rail Extension [DTX] and San Francisco Transbay Transit Center [TTC]. As described in Chapter 4, the ridership analysis for 2040 included an assumed two trains to TTC; with more trains to TTC station ridership at TTC will increase and system ridership may increase overall.

Construction

Under the No Project Alternative, Caltrain would continue to operate between San Francisco and San Jose under the existing conditions. No new construction activities would occur under this alternative. As discussed, other Caltrain projects, such as CBOSS PTC, are presumed to be constructed, but this is the same assumption for the Proposed Project. Thus, for the sake of comparison to the Proposed Project, it is assumed there would be no construction-related impacts associated with the No Project Alternative.

Operation

Aesthetics

Under this alternative, there would be no permanent change to the visual character, views, nighttime lighting, and daytime glare. This alternative would not involve the installation of an Overhead Contact System (OCS) or additional removal of vegetation. Current maintenance trimming of vegetation would continue as at present, but the maintained area would not change (with the Proposed Project the maintained area would expand outward as necessary for the OCS electrical safety zone [ESZ]). Therefore, the No Project Alternative would have no impact on aesthetics, and its impacts would be less than the Proposed Project.

Air Quality

Under this alternative, ~~the same level of~~ criteria pollutants and Toxic Air Contaminants (TACs) would continue to be emitted from the operation of diesel locomotives as at present but the emissions would be lower than existing conditions since the new T4DLs would comply with the far more stringent USEPA T4 emission requirements.

As shown in Table 5-6 ~~5-3~~ below the No Project Alternative would substantially result in greater daily emissions of reactive organic gases (ROG), nitrogen oxides (NO_X), carbon monoxide (CO), and particulate matter less than 10 micrometers in size (PM10) than the Proposed Project due to the effect of cleaner EMUs and due to a lower ridership (and thus higher vehicle-related emissions) than the Proposed Project. These differences in emissions between No Project and Proposed Project conditions in 2020 of the respective criteria pollutants all exceed Bay Area Air Quality Management District (BAAQMD) daily thresholds with the exception of PM2.5 in which the difference is just under the threshold.

Table 5-6 ~~5-3~~. Estimated Operational Emissions by Alternative (pounds per day)

Condition	ROG	NO_X	CO	PM10	PM2.5
Existing (2013)					
Caltrain Diesel Consumption	251	5,973	637	159	154
Caltrain Electricity Consumption	0	6	5	0	0
Total Caltrain System Emissions[a]	**251**	**5,979**	**642**	**159**	**155**
No Project (2020)					
Caltrain Diesel Consumption	45	1,043	731	23	23
Caltrain Electricity Consumption	0	4	4	0	0
Total Caltrain System Emissions[a]	**46**	**1,048**	**735**	**24**	**23**
DMU Alternative (2020)					
Caltrain Diesel Consumption	65	1,496	1,141	32	31
Caltrain Electricity Consumption	0	4	4	0	0
Total Caltrain System Emissions[a]	65	1,501	1,144	33	32
Change in VMT emissions[b]	*-159*	*-330*	*-1,296*	*-181*	*-53*
Total Emissions	**-94**	**1,171**	**-152**	**-148**	**-21**
T4DL-SH Alternative (2020)					
Caltrain Diesel Consumption	56	1,287	873	29	28
Caltrain Electricity Consumption	0	6	5	0	0
Total Caltrain System Emissions[a]	56	1,292	878	29	29
Change in VMT emissions[b]	*-159*	*-330*	*-1,296*	*-181*	*-53*

Condition	ROG	NO_X	CO	PM10	PM2.5
Total Emissions	**-103**	**961**	**-419**	**-151**	**-24**
T4DL-DH Alternative (2020)					
Caltrain Diesel Consumption	66	1,526	1,179	33	32
Caltrain Electricity Consumption	0	6	5	0	0
Total Caltrain System Emissions[a]	66	1,532	1,184	33	32
Change in VMT emissions[b]	*-159*	*-330*	*-1,296*	*-181*	*-53*
Total Emissions	**-93**	**1,201**	**-112**	**-148**	**-20**
Proposed Project (2020)					
Caltrain Diesel Consumption	32	707	131	21	20
Caltrain Electricity Consumption	5	105	86	5	5
Total Caltrain System Emissions[a]	37	812	218	26	25
Change in VMT emissions[b]	*-159*	*-330*	*-1,296*	*-181*	*-53*
Total Emissions	**-122**	**482**	**-1,078**	**-155**	**-27**
No Project (2040)					
Caltrain Diesel Consumption	23	539	689	8	8
Caltrain Electricity Consumption	0	4	4	0	0
Total Caltrain System Emissions[a]	**23**	**543**	**693**	**8**	**8**
DMU Alternative (2040)					
Caltrain Diesel Consumption	43	1,025	1,312	15	15
Caltrain Electricity Consumption	0	6	5	0	0
Total Caltrain System Emissions[a]	43	1,031	1,316	16	15
Change in VMT emissions[b]	*-390*	*-807*	*-3,093*	*-387*	*-116*
Total Emissions	**-346**	**224**	**-1,776**	**-371**	**-101**
Total Emissions (same ridership as PCEP)[c]	*-444*	*22*	*-2,550*	*-468*	*-129*
T4DL-SH Alternative (2040)					
Caltrain Diesel Consumption	30	707	905	11	10
Caltrain Electricity Consumption	0	6	5	0	0
Total Caltrain System Emissions[a]	30	713	910	11	11
Change in VMT emissions[b]	*-390*	*-807*	*-3,093*	*-387*	*-116*
Total Emissions	**-360**	**-96**	**-2,184**	**-376**	**-105**
Total Emissions (same ridership as PCEP)[c]	*-457*	*-298*	*-2,958*	*-473*	*-134*
T4DL-DH Alternative (2040)					
Caltrain Diesel Consumption	40	946	1,211	14	14
Caltrain Electricity Consumption	0	6	5	0	0
Total Caltrain System Emissions[a]	*40*	*952*	*1,216*	*14*	*14*
Change in VMT emissions[b]	*-390*	*-807*	*-3,093*	*-387*	*-116*
Total Proposed Project Emissions	**-350**	**145**	**-1,877**	**-372**	**-102**
Total Emissions (same ridership as PCEP)[c]	*-447*	*-57*	*-2,650*	*-469*	*-131*
Full Electrification (2040)					
Caltrain Diesel Consumption	1	26	33	0.4	0.4
Caltrain Electricity Consumption	6	133	109	6	6
Total Caltrain System Emissions[a]	*7*	*159*	*142*	*7*	*7*
Change in VMT emissions[b]	*-487*	*-1,009*	*-3,866*	*-483*	*-145*

Condition	ROG	NO_X	CO	PM10	PM2.5
Total Full Electrification Emissions	**-480**	**-850**	**-3,724**	**-477**	**-138**
Comparisons					
2020 Project vs. 2020 No Project	-168	-566	-1,813	-179	-50
2020 DMU vs. 2020 No Project	-139	**123**	-885	-172	-44
2020 T4DL-SH vs. 2020 No Project	-148	-86	-1,153	-175	-47
2020 T4DL-DH vs. 2020 No Project	-138	**153**	-847	-171	-43
2040 Full Elec. vs. 2040 No Project	-503	-1,393	-4,417	-485	-146
2040 DMU vs. 2040 No Project	-369	-319	-2,469	-379	-109
2040 DMU vs. 2040 No Project (same ridership as PCEP scenario)	*-467*	*-521*	*-3,242*	*-476*	*-137*
2040 T4DL-SH vs. 2040 No Project	-383	-639	-2,877	-384	-113
2040 T4DL-SH vs. 2040 No Project (same ridership as PCEP scenario)	*-480*	*-840*	*-3,650*	*-481*	*-142*
2040 T4DL-DH vs. 2040 No Project	-372	-398	-2,570	-381	-110
2040 T4DL-DH vs. 2040 No Project (same ridership as PCEP scenario)	*-470*	*-600*	*-3,343*	*-477*	*-139*
BAAQMD Thresholds	**54**	**54**	**N/A**	**82**	**54**

[a] Includes diesel and electricity emissions but not VMT-related reductions due to increased ridership.

[b] Change in VMT emissions relative to No Project conditions. For 2020, DMU, T4DL-SH, and T4DL-DH alternatives all assumed to have same ridership as PCEP, even though these alternatives would have lesser performance than Proposed Project. For 2040, DMU, T4DL-SH, and T4DL-DH assumed to have 80% of increase in ridership as PCEP over No Project conditions (due to not reaching TTC), but assumption does not take into account lesser performance.

[c] Sensitivity analysis uses assumption that alternative would have same ridership and same VMT reductions as Proposed Project.

[d] All impacts are less than significant except 2020 DMU and T4DL-DH NOx increases over No Project conditions.

~~As discussed in Section 3.2, *Air Quality*, the Proposed Project would reduce diesel particulate matter (DPM) emissions by approximately 80 percent compared with current conditions. Another way of looking at this issue is that the No Project Alternative would result in 80 percent higher health risks associated with DPM to residents along the Caltrain ROW.~~

The No Project Alternative would reduce diesel particulate matter (DPM) emissions by 85 percent compared to existing conditions. An example was provided in Section 3.2, *Air Quality*, of an area in Menlo Park proposed for mixed use where the current diesel locomotives would result in an indoor risk of cancer from DPM emissions of 39 ~~24~~ in a million, but the Proposed Project would reduce that level to 5.0 ~~7~~ in a million in 2020. The No Project Alternative would have similar effects of reducing the risks along the right of way due to DPM emissions to 5.7 in a million in 2020.

As discussed below for the DMU Alternative and in Section 3.2, the effect of tree removal avoidance compared to the Proposed Project on particulate emissions and health risks and other emissions (such as pantograph wear emissions) is likely minimal and would not change the conclusions noted above.

Therefore, due to the substantially higher criteria pollutant emissions, the No Project Alternative would have substantially higher impacts on air quality than would the Proposed Project but the No Project Alternative would represent a substantial improvement over existing conditions.

Biological Resources

This alternative would avoid new impacts on biological resources. Existing tree trimming to maintain physical clearance zones for trains would continue but would not be expanded as in the Proposed Project.

This alternative would have continued diesel emissions along the Caltrain ROW, which would result in continued deposition of diesel contaminants into adjacent upland and aquatic areas. In addition, diesel emissions also result in nitrogen deposition adjacent to the Caltrain ROW and in areas a number of miles from the Caltrain ROW. As discussed in Section 3.3, *Biological Resources*, deposition of nitrogen from vehicle emissions and other emission sources has resulted in a "fertilization effect" in natural areas that has favored non-native species over some native species, in particular affecting habitat for host plants for certain rare butterfly species.

Cultural Resources

Operation of the No Project Alternative would not impact cultural resources. Therefore, for operations under this alternative, the impact on cultural resources would be similar to the Proposed Project (which would affect cultural resources during construction but not during operations).

Electromagnetic Fields/Electromagnetic Interference

Operation of the No Project Alternative would not involve an OCS or a similar system with the change in electromagnetic fields (EMF) levels or the potential for electromagnetic interference (EMI). Therefore, impacts associated with EMF/EMI would be less than the Proposed Project.

Geology, Soils and Seismicity

Operation of this alternative would not result in any new exposure of structures and people to seismic, soil, or geologic hazards or result in any impacts on paleontological resources Therefore, impacts associated with geologic, soil, or seismic hazards would be less than the Proposed Project.

Greenhouse Gas Emissions and Climate Change

Under this alternative, the continued use of diesel fuel would emit greenhouse gas (GHG) emissions that contribute to the effects of climate change. While the USEPA Tier 4 emissions requirements for new diesel locomotives would result in much lower criteria pollutant emissions compared to existing conditions, the Tier 4 requirements do not include any requirement for reduction of GHG emissions. Because the new T4DLs are more powerful than the existing diesel locomotives, they would consume more fuel than the existing diesels they are replacing and thus GHG emissions would increase compared to existing conditions.

Operation of the diesel locomotive engines emits more GHG emissions than electric engines in the Proposed Project EMUs, taking into account both direct engine GHG emissions as well as indirect GHG emissions from electricity generation. In addition, the No Project Alternative would result in less increased Caltrain ridership than the Proposed Project, meaning greater passenger vehicle GHG emissions as well. As shown in Table 5-8 ~~5-4~~ below, the Proposed Project would result in 79,000 ~~68,000~~ metric tons (MT) of carbon dioxide equivalent (CO_2e) less than the No Project Alternative in 2020. Therefore, this alternative would have a greater impact associated with GHG emissions.

Regarding the effects of climate change, the potential future impacts of sea level rise on the Caltrain ROW would be similar to the Proposed Project in terms of the track and station vulnerability, but the No Project Alternative would not have any new OCS or traction power facilities (TPFs) potentially subject to flooding, so its vulnerability would be slightly less than the Proposed Project.

Hazards and Hazardous Material

Under this alternative, there would be an ongoing potential for the release of and exposure to diesel fuel and other hazardous materials during maintenance activities. Operation of this alternative would also generate hazardous waste material from the use of lubricants and solvents. These impacts would not represent an increase over existing conditions. However, compared with the Proposed Project, the No Project Alternative would require much more handling and transfer of diesel fuel, which increases the potential for release of diesel. Therefore, this alternative would have greater impacts associated with the release of and exposure to hazardous materials than the Proposed Project would have.

Hydrology and Water Quality

Under this alternative, the impervious area in the project area and drainage would remain the same as at present. This alternative would not require the construction of TPFs or the OCS. Therefore, operation of this alternative would not increase stormwater runoff that could degrade water quality. Although this alternative would avoid any new facilities or impervious area, the No Project Alternative would require much more handling and transfer of diesel fuel, which would increase the potential for release of diesel that may affect water quality. Because the Proposed Project's operational impact on water quality is readily addressed through application of existing regulations and because the Proposed Project would require far less handling of diesel fuel, the No Project Alternative is considered to have a higher risk of spills and water quality effects than the Proposed Project.

The areas of the Caltrain ROW and associated facilities potentially subject to flooding would remain the same. The Proposed Project would place some new facilities into the 100-year floodplain that would be subject to flooding effects, but mitigation is available to reduce effects to a less-than-significant level. Both the No Project Alternative and the Proposed Project would have similar vulnerabilities to future flooding associated with sea level rise, but the Proposed Project would place slightly more facilities at risk than the No Project Alternative. Thus, the No Project Alternative would have less impact related to flooding than the Proposed Project.

Land Use and Recreation

Under this alternative, operation would not require installation of the OCS, removal of trees, acquisition of land adjacent to the Caltrain ROW and operation of traction power substations in the City of South San Francisco and the City of San Jose. Operation of this alternative would not physically divide an existing community, would create no new conflicts with land use policies or plans (or tree ordinances), or increase the demand for recreational facilities. Therefore, this alternative would have less impact on land use and recreation than the Proposed Project.

However, as noted above, the Proposed Project would have substantially lower health risk effects due to diesel emissions than the No Project Alternative, which would mean areas next to the Caltrain ROW would be more suitable for residential and mixed use with the Proposed Project.

Noise and Vibration

Under this alternative, noise and vibration levels would not change relative to train operations. Operation of locomotive-hauled diesel engine vehicles would generate a higher level of noise than the Proposed Project's EMUs would generate. Based on Table 3.11-15, in Section 3.11, *Noise and Vibration*, and presuming that the No Project Alternative would have noise levels similar to existing levels, the following conclusions can be made for the 49 study locations.

- Noise levels higher with the No Project Alternative: 41~~33~~ study locations.

- No change between No Project Alternative and Proposed Project: ~~8~~No locations.
- Noise levels lower with the No Project Alternative: 8 locations.

Therefore, this alternative would have a greater impact on sensitive receptors from noise than the Proposed Project, although impacts will be worse at 8 locations with the Proposed Project.

As discussed in Section 3.11, *Noise and Vibration*, vibration levels are not substantially different for diesel locomotives and EMUs, so the No Project Alternative would be similar to the Proposed Project for vibration.

Population and Housing

This alternative would not directly or indirectly induce population growth in the project area through new employment or new housing units, or displace existing businesses or housing units. Therefore, this alternative would have a similar impact on population and housing as the Proposed Project.

Public Services and Utilities

Operation of the existing Caltrain service would not increase the demand for public services or disrupt utilities. Under this alternative, the impact on public services and utilities would be the similar to the Proposed Project for operations.

Transportation/Traffic

Regional Traffic

Caltrain ridership would be lower with the No Project Alternative and thus regional traffic conditions would be worse than with the Proposed Project as the No Project Alternative would result in approximately 235,000 more vehicle miles per day than the Proposed Project in 2020 (with greater differences in 2040).

Localized Traffic

Under this alternative, the gate-down time would be reduced at some at-grade crossings due to the installation of CBOSS PTC and would not be increased due to increased service. Compared with the Proposed Project, gate-down times would be shorter during peak hours at 16 out of the 29 at-grade crossings with gates in the project area, longer at six crossings, and longer during one peak period but shorter during the other peak period at the remaining seven crossings.

As described above, ridership will increase with or without the Proposed Project (due to general growth on the San Francisco Peninsula) but would increase substantially more with the Proposed Project. In addition, background growth will continue to result in worsened localized traffic levels.

Taking these factors into account, the traffic analysis shows that the No Project Alternative would have less impact on localized traffic delays at the at-grade crossings and near Caltrain stations. As discussed in Section 3.14, *Transportation and Traffic,* compared with No Project conditions, the Proposed Project would have significantly worse traffic impacts at 21 study locations (out of 82 study locations) under project 2020 conditions. As discussed in Section 4.1, *Cumulative Impacts,* compared with 2040 No Project conditions, there would be significant cumulative traffic impacts at 39 study locations (out of 82 study locations). Thus, the No Project Alternative would result in less localized traffic impacts around Caltrain stations and at certain at-grade crossings.

Transit Systems

As discussed in Section 3.14, *Transportation and Traffic,* the Proposed Project would not substantially change the ridership of other transit systems compared with No Project conditions; thus, the alternatives are similar for impacts on transit systems. The No Project Alternative would avoid any potential OCS-related conflict with other transit projects (such as the 22-Fillmore Project or DTX). However, the No Project Alternative would be in conflict with the DTX and TTC projects because it would only provide for continued diesel train operations as opposed to the electrified operations anticipated by DTX and TTC.

Pedestrian/Bike Facilities

As discussed in Section 3.14, *Transportation and Traffic,* the Proposed Project would have a less than significant impact on pedestrian facilities with mitigation. Since ridership would increase with the No Project Alternative, but less than with the Proposed Project, the No Project Alternative would have a smaller less than significant impact on pedestrian facilities, although mitigation may still be needed at the San Francisco 4th and King Station to accommodate pedestrian traffic.

As discussed in Section 3.14, *Transportation and Traffic* and Section 4.1, *Cumulative Impacts*, the Proposed Project would result in an increased demand for bike facilities, but mitigation measures identified in these sections would address this increased demand. There would also be an increase in demand for bike facilities with the increased ridership expected with the No Project Alternative; however Caltrain could address this demand by similar means. Because the No Project alternative would result in a lower demand for bicycle facilities, it would have a lesser impact than the Proposed Project relative to bicycle facilities.

Station Parking and Access

As discussed in Section 3.14, *Transportation and Traffic* and Section 4.1, *Cumulative Impacts*, the Proposed Project would result in an increased demand for parking, but this increase demand is not expected to result in significant secondary impacts on the environment related to air quality, noise, traffic or due to the construction of parking facilities. The No Project Alternative would result in a lower increase in parking demand thus alternative would have less impact than the Proposed Project relative to parking demand.

Emergency Vehicle Access

Because the No Project Alternative would result in more regional vehicle miles traveled, on a regional basis it would have greater impacts on emergency response times than the Proposed Project would have.

Freight Service Impact

The No Project Alternative would avoid any impacts on freight service in the direct or cumulative context, which~~, presuming the Federal Railroad Administration (FRA) waiver requirements for temporal separation remain in force,~~ would mean this alternative would have less impact on freight service than the Proposed Project would have because it would avoid any impacts related to constraining future freight due to OCS clearance heights. ~~If the FRA waiver requirement for temporal separation is revised in current FRA rule-making to eliminate or reduce the time needed for temporal separation, then the Proposed Project may not require a change in freight operational hours.~~

5.2.2 Diesel Multiple Unit (DMU) Alternative

As explained in Section 5.4, *Alternative Screening Process* below, the DMU Alternative is considered feasible, would avoid or substantially reduce one or more significant impacts of the Proposed Project and would meet some, but not all of the project's purpose and need.

The DMU Alternative would not meet the project's purpose to provide electrical infrastructure compatible with high-speed rail. ~~This purpose is fundamental to the project, especially given that the primary source of funding for the project's construction would be Proposition 1A high-speed rail bond funds. Because this alternative fails to meet this fundamental purpose, the JPB could decide not to analyze it in this EIR.~~

In addition, while the increase train service under this alternative would increase revenue, this alternative would also increase diesel fuel consumption compared with existing conditions[1] which would increase operating fuel costs. ~~and~~ This alternative would likely have lower ridership than the Proposed Project due to a slower acceleration profile. Therefore, this alternative would only partially meet the project's objectives ~~purpose and need~~ to increase operating revenue and would not meet the objective to reduce operating fuel costs. ~~However, there has been community interest, expressed most recently in scoping comments, in the analysis of a DMU Alternative and, thus, the JPB decided to provide this alternative analysis for informational purposes.~~

DMUs are self-propelled diesel-mechanical vehicles with engines located below the passenger compartment. DMUs include single- and bi-level versions that are available either as individual units or married pairs.[2] The married pairs are typically powered by two diesel engines with maintenance requirements similar to bus engines. As indicated in Table 5-1, DMUs have initial acceleration rates of approximately 1.8 ~~1.4~~ mph per second (Stadler 2009 ~~EOT 2008~~) and operate at maximum speeds of 65 to 100 mph (Mass. EOT 2008). DMUs can also act as "locomotives" and either push or pull trailer cars. However, the addition of trailer cars reduces acceleration performance.

All DMUs derive their power from a diesel engine which then transmits motive power to the wheels either mechanically via gearbox, through a hydraulic torque converter, or to an electrical generator which then drives electric traction motors which drives the wheels. ~~DMUs are powered by diesel engines, which drive an axle through a hydraulic torque converter, and some DMUs utilize direct mechanical or electrical transmissions~~. DMUs are configured to use diesel engines to generate electricity, which powers the electric propulsion motor. The diesel engines can burn low sulfur diesel fuel and would meet state and federal air quality standards (BART 2008).

The key DMU characteristics related to desired service improvements is the reduction of running times due to faster acceleration than traditional push-pull service. DMUs require less time to accelerate up to full speed from stations stops and slow areas, reducing overall travel times, particularly on a corridor featuring frequent stops. New DMUs could also be configured with up to three sets of automatic doors, reducing the time trains spend stopped in stations. A DMU with three

[1] 2020 No Project diesel consumption is estimated as ~~4.5~~ 5.6 million gallons/year compared with 2020 DMU Alternative diesel consumption of 6.9 ~~7.1~~ million gallons/year. With the eight-car DMU consist assumed for this analysis, diesel fuel consumption would be approximately 3.9 gallons/revenue mile (including non-revenue service and idling) compared with today's diesel locomotive five-car consists which consume approximately 3.1 gallons/revenue mile (including non-revenue service and idling). In general, DMUs are more fuel efficient than diesel locomotives for consists of five cars or fewer but less fuel efficient for consists longer than five cars. The Proposed Project includes six-car consists to accommodate approximately 600 passenger seats per train to meet ridership demands. Thus, an eight-car DMU was assumed to accommodate a similar level of passengers. Train length and fuel efficiency are two reasons that a DMU option is not as favorable for the Caltrain service as EMUs, among many other considerations.

[2] Married pairs are two single cars that are permanently connected and operate in pairs or multiples of pairs.

sets of doors would therefore speed the boarding process during these periods (Mass. EOT 2008).

For the purposes of this alternative analysis, the following assumptions were made.

- An eight-car single-level DMU train, with a capacity of 78 passengers per car (624 passengers per train) was analyzed in order to analyze an alternative that would roughly match the capacity ~~ridership~~[3] per train ~~capacity~~ of the Proposed Project (Caltrain 2011).
- Only a single-level is being evaluated because a double-deck would not fit in the Caltrain system tunnels and because there is no existing market for double-deck DMUs.
    - There is no established current domestic or international double deck or bi-level DMU market in which proven platforms are readily available for sale by multiple suppliers. A search of the websites of major DMU manufacturers (like Siemens, Nippon Sharyo/Sumitomo and Bombardier) could not locate any details on new bi-level DMUs in production. The Caltrain 2011 technology assessment (Caltrain 2011) examined double-deck DMUs and identified a nominal vertical height of 19' 8" which would not fit in any of the SF tunnels. This is the basis of the conclusion in the EIR that the double-deck DMUs could not fit in the San Francisco Tunnels. U.S. Railcar (formerly Colorado Railcar) has manufactured double-deck DMUs with a height of 19'10" in the past, several of which are in operation in the U.S. (US Railcar, no date), but no reference to new double-deck DMUs are in production or on order by US Railcar.
    - While it is possible that a DMU could be developed to fit within the Caltrain clearance envelope, maximizing passenger capacity within the constraints of existing platform lengths (basically a six-car train), such a train would not typically have the horsepower-to-weight ratio and adhesion to match the EMU acceleration rate and deliver the proposed service model. To provide 500 to 600 passenger capacity, the train would have to be bi-level or double deck, similar to Caltrain's existing coach fleet. To meet the desired acceleration rate, every vehicle would have to be fitted with diesel propulsion packages, which take up valuable passenger space and add weight, reducing the overall benefit that the DMU concept provides, which is a scalable train. Traditionally, analyses performed for the Colorado Railcar prototype double deck DMU indicated that locomotive hauled trains were more economical than DMUs once the train length reached approximately six cars. Furthermore, that prototype vehicle was 19 feet tall, roughly 4 feet taller than the existing gallery and bi-level cars. A DMU of this height would not fit through the Caltrain tunnels. This extra height was required to allow two full levels of seating, with the engines being installed beneath the main floor.
    - In concept, a 16-foot double deck DMU would give up most of the lower seating level to propulsion equipment. Alternate concepts have been proposed by US Railcar (the owner of the Colorado Railcar prototype design) in which single level DMUs pull bi-level coaches. This concept was proven at SFRTA in Miami by Colorado Railcar prior to construction of the double deck DMU prototypes. This provides a train that will meet the Caltrain clearance requirement, but does not meet the EMU acceleration performance . Given these factors, Caltrain would be better off retaining their existing locomotive-hauled trains, as neither the DMU nor DMU-Hauled coach concept would be able to practically deliver the proposed service model. Caltrain service would soon reach maximum capacity, and commuters would be required to look elsewhere for a means of transportation on the peninsula. If Caltrain commissioned the design and construction of a diesel trainset that met all of the requirements for the proposed service model (which the current selection of off-the-shelf double deck EMUs meet), a considerable schedule and budget risk would be imposed. It is very likely that there would be a single proposer, with limited passenger rolling stock production experience, and the design would be new, unique, and therefore unproven.

[3] The Proposed Project capacity is roughly 600 passengers per train.

- It was assumed that the Caltrain service schedule for the DMU Alternative would be the same as the Proposed Project but with lower ridership. DMUs do not accelerate ~~or decelerate~~ as fast as EMUs and, thus, either the number of station stops would likely have to be reduced to maintain the same trip time as the Proposed Project EMUs or travel times would be greater (Caltrain 2011).
- The eight-car single-level DMU train length of 680 feet would exceed the length of Caltrain platforms at most Caltrain stations and would require platform extension construction. A review of these stations indicates that the 680 feet length could be technically be achieved but there could be cross-street issues at Burlingame, San Mateo, Mountain View and Sunnyvale. There are also platform issues not related to cross-streets at some other stations.
- The DMU Alternative is assumed to terminate at the San Francisco 4th and King Station and would not proceed to the ~~Transbay Terminal Center (~~TTC~~)~~ because the ~~Downtown Extension (~~DTX~~) tunnel~~ and the TTC are designed only for electric trains. Even if ventilation were added to the DTX ~~tunnel~~, the TTC is a fully enclosed station that is not designed to handle the emissions from diesel train operations in the enclosed station. Many fully enclosed stations and tunnels, like the tunnels leading to Grand Central Station and Penn Station in New York City prohibit diesel operations due to health concerns. Other major downtown stations that allow diesel operations, such as Union Station in Chicago, face substantial controversy concerning diesel emissions in constrained spaces. Thus, due to the design of the DTX ~~tunnel~~ and the TTC and due to the health concerns about diesel emissions in enclosed spaces, this alternative does not include service to TTC.

~~No specific cost estimate was prepared for the DMU Alternative. Although this alternative would avoid the construction costs associated with the TPFs and OCS for the Proposed Project, this alternative would require construction of platform extensions. Maintenance and fuel costs over this alternative's lifetime would be similar to or higher than under the Proposed Project. Overall lifecycle costs are considered similar to the Proposed Project's costs (Caltrain 2011).~~

The assumptions above are based on FRA Alternative Compliant light-weight DMUs. ~~The FRA sets crash-worthiness standards for all passenger vehicles (including DMUs) and prohibits light-weight DMUs from operating on the same line as freight without substantial time separation (like the EMUs). The heavier rail vehicles used in traditional commuter rail operations or heavy DMUs have sufficient structural strength to operate on the same tracks as freight train traffic without temporal separation (BART 2008).~~

The base assumption for this alternatives analysis is that the DMU Alternative would use light-weight DMUs. However, where appropriate, the analysis describes what the impacts would be if FRA compliant heavy-weight DMUs were used (for example, in the air quality section ~~and the impact on freight operations~~).

Relative to ridership, the DMU alternative is assumed to result in less ridership than the Proposed Project due to the inferior acceleration~~/decelerations~~ performance compared with EMUs. While service would increase to six trains per peak hour per direction (pphpd), either the travel time will be longer or there will be fewer stations served compared with the EMUs. Both would affect ridership. While ridership was not modelled for the DMU alternative, it is presumed to be somewhat less than the Proposed Project accordingly, but substantially more than the No Project Alternative. <u>For the air quality and GHG emissions analysis in the EIR, a conservative assumption was made that the DMU Alternative would have the same ridership for 2020 as the PCEP, but would have only 80 percent of the ridership increase of the PCEP in 2040 compared to the No Project to reflect the inability to reach TTC.</u>

Construction Impacts

This alternative would involve replacing the existing Caltrain diesel locomotive-hauled vehicles with new light- or heavy-weight DMU vehicles. As discussed above, depending on the DMU trainsets selected, Caltrain platforms that are less than 680 feet in length would need to be extended.

The Proposed Project's construction at the Caltrain station is limited to OCS poles and wires. At the San Francisco tunnels, the Proposed Project would install OCS poles and wires as well as some minor notching to make room for the OCS poles and wires. The Proposed Project is consistent with the DTX ~~tunnel~~/TTC design.

The DMU Alternative would have greater construction impacts at the Caltrain stations but would require no construction at other locations. Overall, the areas of disturbance would be far less with the DMU Alternative, but the intensity of construction at the Caltrain stations for this alternative would be far higher. The following 20 stations have one or more platforms that are less than 680 feet in length: San Francisco 4th and King, 22nd Street, South San Francisco, San Bruno, Millbrae, Broadway, Burlingame, San Mateo, Hayward Park, Hillsdale, Belmont, San Carlos, Redwood City, Atherton, Menlo Park, California Avenue, San Antonio, Mountain View, Sunnyvale, and Santa Clara. Platform extension at Caltrain stations would require grading, excavation, pouring of concrete, and potential utility relocates. Because some of the stations are historic stations, care would need to be taken to avoid impacts on the historic features, similar to that required in placing the OCS facilities with the Proposed Project. There would also be temporary air emissions and noise at the construction locations. In addition, there could be temporary utility disruption if utilities are present in platform extension areas.

Overall, although the DMU Alternative would have greater impacts at Caltrain stations than the Proposed Project, given the smaller overall area of effect, this alternative would have less construction-related impacts than the Proposed Project in all subject areas with the exception of historic resources. Because this project would require platform changes at Caltrain stations, some of which are historic, the DMU Alternative could have similar or potentially higher impacts on cultural resources than the Proposed Project.

Because the DMU Alternative would include construction, but the No Project Alternative would not, the DMU Alternative would have higher construction impacts.

Operational Impacts

Operation of light- vs. heavy-weight DMUs would have similar environmental impacts with the exception of air quality, GHG emissions, and noise~~, and impacts on freight operations~~. The light-weight DMUs have a lighter structure and require less diesel fuel to operate. As a result, impacts associated with air quality, GHG emissions, and noise would be different for light- vs. heavy-weight DMUs. ~~For freight operations, FRA-compliant heavy-weight DMUs would not require changes in freight operational hours from the current 8 p.m. to 5 a.m. window, whereas non-compliant light-weight DMUs may require temporal separation from freight trains, and freight may be restricted to a midnight to 5 a.m. window (as would be required with the light-weight EMUs in the Proposed Project).~~

The analysis discussion for all resource areas, except where impacts differ and as noted, is applicable to light- and heavy-weight DMUs.

Aesthetics

This alternative would not involve the installation of an OCS or TPFs or additional removal of vegetation. Current maintenance trimming of vegetation would continue as at present, but the

maintained area would not change (with the Proposed Project the maintained area would expand outward as necessary for the OCS ESZ).

This alternative would require extension of a number of Caltrain station platforms, which would change the visual appearance of the affected stations with additional concrete platform areas. But with extended platforms, the change in visual appearance would likely be less than significant given it would be at-grade and can be designed to be consistent with the aesthetics of existing platforms.

Overall, the DMU Alternative would result in less permanent impacts than the Proposed Project on aesthetics along the Caltrain ROW because there would be no need for additional tree removal and an OCS, taken into consideration the changes in platform length.

Because the DMU Alternative would include visual changes at the Caltrain stations, but the No Project Alternative would not, the DMU Alternative would have higher aesthetic impacts than the No Project Alternative.

Air Quality

Emissions resulting from DMU operations were compared with EMU operations emissions under the Proposed Project. The DMUs included in this alternative are presumed to meet the USEPA Tier 4 emissions standards.

As noted above, no ridership evaluation was conducted for the DMU Alternative. As a conservative assumption, it was assumed that the DMU Alternative would result in the same increased 2020 ridership as the Proposed Project for the sake of analysis only. However, this is not likely a realistic assumption as DMU performance would be inferior to EMUs in terms of acceleration ~~and deceleration~~ and, thus, DMU travel times would be longer than EMUs for the same trip or the DMUs would not be able to stop at as many stations as the EMUs. In either case, this alternative would likely have a lower ridership than the Proposed Project and, thus, would have higher VMT-related criteria pollutant emissions than shown in Table 5-6 ~~5-3~~ below for 2020. For 2040, the DMU Alternative would not extend to TTC and, thus, would have substantially lower ridership and higher VMT-related criteria pollutant emissions than the Proposed Project. A sensitivity analysis assuming the same 2040 ridership as the Proposed Project is also provided.

As shown in Table 5-6 ~~5-3~~ below, due to higher Caltrain diesel daily consumption, the DMU Alternative would result in substantially higher daily emissions of ROG, CO, NO_X, PM10, and slightly higher emissions of particulate matter less than 2.5 micrometers in size (PM2.5) along the Caltrain ROW than the Proposed Project in both the 2020 project scenario and the 2040 fully electrified scenario. When taking into account the indirect electricity emissions and assuming the same ridership as the Proposed Project, the DMU alternative would still have substantially higher criteria pollutants in both the 2020 and 2040 scenarios. The difference~~s~~ in NO_X emissions between the DMU Alternative and the Proposed Project for 2020 are well above the BAAQMD threshold.

Because the quantitative analysis of DMUs was based on light-weight DMU vehicles, as noted above, the emissions of heavy-weight DMUs would be more than the base analysis for the eight-car single-level light-weight DMU shown in Table 5-6 ~~5-3~~. In the EIR prepared for the Sonoma-Marin Area Rail Transit (SMART) rail project (SMART 2008), it was estimated that light-weight DMUs would have approximately 20 percent lower emissions than FRA-compliant DMUs. Assuming the heavier-weight FRA compliant DMU would have 20 percent higher emissions, heavy-weight DMUs would have even more emissions than the Proposed Project along the Caltrain ROW.

The PM10 emissions shown in Table 5-6 are those associated with train diesel combustion, electricity generation, and reductions in VMT-related remissions. Using the same methodology in Section 3.2, Air Quality, additional analysis of the alternatives was conducted relative to other sources of particulates including wheel-rail contact, entrained particulates from induced wind,

pantograph wear, and the effect of tree removal. Refer to Section 3.2, Air Quality for a description of the methodology used. Table 5-7 shows the results of a conceptual analysis of particulates including all these sources.

As shown by the analysis in Table 5-7, even using highly conservative assumptions, the Proposed Project taking into account wheel-rail contact, entrained particulates, pantograph particulates, and potential effects due to tree removal would not substantially change the overall conclusions of the analysis shown in Table 5-6. The analysis in Table 5-7 is for illustrative purposes as the methods and assumptions used for the analysis of emissions other than diesel emissions, electricity generation and VMT-related emissions involves a high level of uncertainty and thus does not have a sufficient level of scientific certainty in the result. Thus, the results presented in Table 5-6 represent the best estimate of particulate emissions for the Proposed Project compared to other alternatives.

Based on the PM10 emissions shown in Table 5-6 ~~5-3~~, the DMU Alternative would also have higher DPM emissions associated with Caltrain diesel trains along the Caltrain ROW and would result in slightly higher health risks associated with DPM for residents along the Caltrain ROW compared with the Proposed Project. Using the example provided in Section 3.2, *Air Quality*, of an area in Menlo Park proposed for mixed use where the current diesel locomotives would result in an indoor risk of cancer from DPM emissions of 39 ~~24~~ in a million, and assuming that the health risks are directly proportionate to daily PM10 emissions, the cancer health risks associated with the DMU Alternative (light-weight vehicle) would be just ~~over~~ under 8 ~~11~~ in a million in 2020 at the modeled location. As noted in Section 3.2, *Air Quality*, the Proposed Project would reduce the health risk at this location to approximately 5~~7~~ in a million in 2020.

In 2020, the DMU Alternative would have lower ~~Caltrain system~~ emissions compared with the No Project Alternative for all criteria pollutants other than NOx ~~CO and overall lower emissions when taking into account VMT reductions~~. In 2040, the DMU Alternative would result in ~~higher~~ lower ~~Caltrain system~~ emissions compared with the No Project Alternative for all criteria pollutants. ~~This increase in emissions is based on the modeling assumption that diesel locomotives would be replaced over time to meet current emissions standards under the No Project Alternative, while the 2040 DMU fleet would still be dominated by the 2020 DMU purchase. However, when taking into account VMT reductions, the DMU Alternative would have less criteria pollutant emissions in the 2040 scenario.~~

In 2020, DPM health risks resulting from the DMU Alternative would be slightly more ~~less~~ than under the No Project Alternative due to slightly higher ~~lowered~~ PM emissions along the Caltrain ROW. The risks would be slightly higher in 2040 due to higher PM emissions along the Caltrain ROW.

Therefore, this alternative would have a greater impact on air quality than the Proposed Project ~~would have but a decreased impact overall~~ and would have lower impacts relative to some pollutants and higher impacts relative to some pollutants compared with the No Project Alternative.

Biological Resources

With this alternative, existing tree trimming to maintain physical clearance zones for trains would continue but would not be expanded as in the Proposed Project. Thus, this alternative would have less ongoing disruption to nesting birds and bats that might be present in trees along the Caltrain ROW.

Table 5-7a. Comparison of 2020 Daily PM10 Emissions using Conceptual Estimates for Other Particulate Sources (lb/day)

	Existing	2020 No Project	PCEP 2020	2020 DMU Alternative	2020 T4 Diesel Locomotive Alternative (DH)	Notes
Diesel Engine Emissions	159	23	21	32	33	From Table 3.2-7.
Wheel-Rail Particulates	NA	NA	NA	NA	NA	Negligible change from existing conditions for PCEP or alternatives per discussion above, so not meaningful for comparison.
Entrained Particulates (Conceptual Estimate)	NA	NA	NA	NA	NA	Area adjacent to ROW is graveled and contains limited soil available for resuspension.
Pantograph Particulate Emissions	0	0	0.5	0	0	
Subtotal Emissions Along ROW	*159*	*23*	*21*	*32*	*33*	
Tree Removal Benefit	NA	NA	NA	NA	NA	Speculative to estimate reductions over entire route given varying tree cover, density, and proximity to route. Tree cover is also absent in many commercial, industrial, and open areas and is low density in other areas.
Subtotal Net Emissions Along ROW	*159*	*23*	*21*	*32*	*33*	
Electricity Emissions	0	0	5	0	0	Non PCEP conditions include a small amount of emissions for idle power when plugged in at terminal.
Total Caltrain System	*159*	*24*	*26*	*33*	*33*	
Lowered VMT emissions	NA	0	-181	-181	-181	VMT reductions are relative to 2020 No Project.
TOTAL	**NA**	**24**	**-155**	**-148**	**-147**	

Table 5-7b. Comparison of Daily PM10 Caltrain Emissions using Conceptual Estimates for Other Particulate Sources (lb/day) For a Hypothetical Mile with Consistent Tree Buffer (Between San Jose and San Francisco)

	Existing	2020 No Project	PCEP 2020	2020 DMU Alternative	2020 T4 Diesel Locomotive Alternative (DH)	Notes
Diesel Engine Emissions	3.24	0.47	0.36	0.64	0.78	Only includes emissions for diesel emissions north of San Jose divided by route miles.
Wheel-Rail Particulates	NA	NA	NA	NA	NA	Negligible change from existing conditions for PCEP or alternatives per discussion above, so not meaningful for comparison.
Entrained Particulates	NA	NA	NA	NA	NA	Area adjacent to ROW is graveled and contains limited soil available for resuspension.
Pantograph Particulates	0.00	0.00	0.01	0.00	0.00	
Subtotal Emissions Along ROW	*3.24*	*0.47*	*0.37*	*0.64*	*0.78*	
Tree Removal Benefit - LOW (Conceptual Estimate)	-0.06	-0.01	0.00	-0.01	-0.02	Used lower range (2%) of Cahill estimate for 8.4 mph wind speed in laboratory study. No reduction assumed for PCEP although replanting mitigation may provide some benefit in certain locations..
Tree Removal Benefit - HIGH (Conceptual Estimate)	-0.84	-0.12	0.00	-0.17	-0.20	Used higher range (26%) of Cahill estimate for 8.4 mph wind speed in laboratory study. No reduction for PCEP. Likely substantially overstates reduction because assumes complete filtering of train diesel emissions by trees next to ROW, when train diesel emissions are emitted vertically and disperse broadly, not horizontally and given periodic openings in most tree buffer areas.
Total Net Emissions per hypothetical mile (Low tree filtration scenario)	*3.18*	*0.46*	*0.37*	*0.63*	*0.76*	*Excludes VMT reductions of PCEP and alternatives*
Total Net Emissions per hypothetical mile (High tree filtration scenario)	*2.40*	*0.35*	*0.37*	*0.47*	*0.58*	*Excludes VMT reductions of PCEP and alternatives*

Note: Even if one used the hypothetical high tree filtration scenario and multiplied by the nominal 51-mile route from San Jose to San Francisco, the difference between the PCEP and the No Project (excluding VMT reduction) would only be 1 lb/day of PM10, which would be less than significant in comparison to the BAAQMD threshold of 54 lbs/day. Multiplying by 51-miles and including VMT reduction, the PCEP would have lower PM10 emissions than existing, No Project, and Tier 4 Diesel Locomotive Alternative conditions.

This alternative would have continued diesel emissions along the Caltrain ROW (higher than the Proposed Project), which would result in continued deposition of diesel contaminants into adjacent upland and aquatic areas. In addition, diesel emissions also result in nitrogen deposition (higher than the Proposed Project) adjacent to the Caltrain ROW and in areas a number of miles from the Caltrain ROW. As discussed in Section 3.3, *Biological Resources*, deposition of nitrogen from vehicle emissions and other emission sources has resulted in a "fertilization effect" in natural areas that has favored non-native species over some native species, in particular affecting habitat for host plants for certain rare butterfly species.

With the DMU Alternative, diesel and nitrogen emissions regionally would be less than the No Project Alternative and thus this alternative would have fewer related effects on biological resources than the No Project Alternative.

Cultural Resources

Operation of this alternative would not impact archeological, cultural, or historical resources. DMUs would operate within the existing Caltrain ROW and on the existing tracks, and would not require modifications or removal of existing historical structures. Therefore, operational impacts on cultural resources would be the same as the Proposed Project and the No Project Alternative.

Electromagnetic Fields/Electromagnetic Interference

Operation of DMUs would not require an overhead OCS. Instead, the DMUs would be powered by onboard diesel engines. The operation of this alternative would not increase the level of electromagnetic fields along the Caltrain corridor and project vicinity, or increase electromagnetic interference. Therefore, the potential impacts associated with EMF and EMI would be less than the Proposed Project and the same as the No Project Alternative.

Geology, Soils and Seismicity

Under this alternative, operation of the Caltrain service would be in the same project area as the Proposed Project and would expose structures and people to the same seismic, soil, and geologic hazards as the Proposed Project. Therefore, the exposure of risks associated with seismic, soil, and geologic hazards would be the same as the Proposed Project and the No Project Alternative.

Greenhouse Gas Emissions and Climate Change

The DMU Alternative would result in greater GHG emissions overall than the Proposed Project but less overall than the No Project Alternative when taking into account all changes in emissions, including changes in VMT and associated passenger vehicle emissions.

The DMUs included in this alternative are presumed to meet the USEPA Tier 4 emissions standards, but the Tier 4 standards concern criteria pollutants, not GHG emissions.

Operation of the DMUs would emit substantially more GHG emissions than electric engines in the Proposed Project EMUs, taking into account both direct engine GHG emissions as well as indirect GHG emissions from electricity generation. While the analysis assumes that the DMU Alternative would result in the same Caltrain ridership as the Proposed Project 2020, this is unlikely to actually occur, meaning that the DMU Alternative would likely result in more passenger vehicle GHG emissions than the Proposed Project (and higher GHG emissions than shown in Table 5-8 ~~5-4~~) for 2020.

Table 5-8 ~~5-4~~. Estimated Operational GHG Emissions by Alternative (metric tons CO_2e per year)

2020 GHG Emissions	Existing	No Project	DMU	T4DL-SH	T4DL-DH	Proposed Project
Caltrain Diesel Consumption	45,899	57,720	71,267	67,502	94,673	11,067
Caltrain Electricity Consumption	*839*	*567*	*753*	*753*	*753*	*11,958*
Total Caltrain System Emissions[a]	46,738	58,287	72,020	68,255	95,426	23,025
Change in VMT[b]	*NA*	*NA*	*-44,317*	*-44,317*	*-44,317*	*-44,317*
Tree Sequestration GHG Loss[c]	NA	NA	NA	NA	NA	260
Total 2020 Emissions	46,738	58,287	27,703	23,938	51,109	-21,032
2040 GHG Emissions	**Existing**	**No Project**	**DMU**	**T4DL-SH**	**T4DL-DH**	**Proposed Project**
Caltrain Diesel Consumption	45,899	59,011	74,050	67,779	94,921	1,511
Caltrain Electricity Consumption	839	567	753	753	753	15,100
Total Caltrain System Emissions[a]	46,738	59,579	74,802	68,531	95,674	16,611
Change in VMT[b]	*NA*	*NA*	*-116,993*	*-116,993*	*-116,993*	*-146,241*
Tree Sequestration GHG Loss[c]	NA	NA	NA	NA	NA	260
Total 2040 Emissions	46,738	58,287	-42,191	-48,462	-21,319	-129,370
Total 2040 Emissions (ridership same as PCEP)[d]	*NA*	*NA*	*-71,439*	*-77,710*	*-50,568*	*NA*

[a] Includes diesel and electricity emissions but not VMT-related reductions due to increased ridership.

[b] Change in VMT emissions relative to No Project conditions. For 2020, DMU, T4DL-SH, and T4DL-DH assumed to have same ridership as PCEP, despite lesser performance. For 2040, DMU, T4DL-SH and T4DL-DH assumed to have 80% of increase in ridership as PCEP over No Project conditions.

[c] Includes annual change in carbon sequestration due to tree loss but does not include increase in carbon sequestration with tree replanting required as mitigation. Assuming a minimum 1:1 tree replacement ratio (actual ratios described in Section 3.3, Biological Resources), carbon sequestration would also increase due to replanting by 3 metric tons of CO_2 in 2020 (1 year after assumed replanting) and by 216 metric tons of CO_2 in 2040 (21 years after replanting) and thus, in time, the mitigation replanting would offset the loss in annual sequestration due to tree removal. As discussed in Section 3.7, Greenhouse Gas Emissions and Climate Change, there would also be a one-time carbon stock loss due to tree removal during construction, but these one-time emissions would be offset by the Proposed Project within approximately 3 months of operation.

[d] Sensitivity analysis uses different assumption that alternatives would have same ridership and same VMT reductions as Proposed Project.

Compared with the No Project Alternative, the DMU Alternative would have greater Caltrain system GHG emissions. The greater emissions would result from the increase in service and from the decreased fuel efficiency of longer DMU consists[4], like the eight-car consist assumed for this alternative. However, the DMU Alternative would have substantially lower emissions than the No Project Alternative overall when including lowered VMT-related emissions resulting from increased Caltrain ridership (using the assumptions noted above).

Hazards and Hazardous Material

Under this alternative, there would be an ongoing potential for the release of and exposure to diesel fuel and other hazardous materials during maintenance activities. Operation of this alternative would also generate hazardous waste material from the use of lubricants and solvents.

Compared with the No Project Alternative, this alternative would result in more Caltrain diesel fuel use due to increased train service, and because an eight-car DMU consist would be less fuel efficient than the current diesel locomotives consists. However, because the DMU Alternative would increase ridership and lower regional VMT, the decreased regional handling of gasoline would likely offset the increased Caltrain handling of diesel in terms of risk of accidents and spillage.

Compared with the Proposed Project, the DMU Alternative would require much more handling and transfer of diesel fuel, which increases the potential for release of diesel. Therefore, this alternative would have greater impacts associated with the release of and exposure to hazardous materials compared than the Proposed Project but likely similar overall impacts as the No Project Alternative.

Hydrology and Water Quality

Under this alternative, the impervious area in the project area would slightly increase with the extension of some Caltrain platforms. This alternative would not require the construction of TPFs or the OCS. With the application of regulatory requirements for addressing stormwater runoff, operation of this alternative would not significantly increase stormwater runoff that could degrade water quality. This alternative would require much more handling and transfer of diesel fuel than the Proposed Project, which would increase the potential for release of diesel that may affect water quality. Because the Proposed Project's operational impact on water quality is readily addressed through application of existing regulations, and the Proposed Project would require far less handling of diesel fuel, the DMU Alternative is considered to have a higher risk of spills and water quality effects than the Proposed Project.

The areas of the Caltrain ROW and associated facilities potentially subject to flooding would remain mostly the same, although additional platform would be needed at the platform for tracks 1 and 2 at the San Francisco 4th and King Station, which is in the 100-year floodplain. The Proposed Project would place some new facilities into the 100-year floodplain that would be subject to flooding effects, but mitigation is available to reduce effects to a less-than-significant level. Both the DMU Alternative and the Proposed Project would have similar vulnerabilities to future flooding associated with sea level rise, but the Proposed Project would place slightly more facilities at risk than the DMU Alternative. Thus, the DMU Alternative would have less impact related to flooding than the Proposed Project.

The DMU Alternative would have slightly higher impacts than the No Project Alternative because it would include additional impervious space in the form of extended Caltrain station platforms. However, the increase in runoff and the change in flooding potential would not be expected to be

[4] Generally, DMUs can be more fuel efficient than diesel locomotives for five-car consists and shorter, but are less fuel efficient for consists longer than five cars. The fuel consumption factors used for this analysis are consistent with that general understanding.

substantial. As described above, the DMU Alternative would require greater diesel duel handling by Caltrain than the No Project Alternative but less gasoline handling overall due to lowered regional VMT. These impact changes offset each other and, therefore, this alternative would have similar water quality impacts related to potential fuel spills or leakage.

Land Use and Recreation

Under this alternative, the OCS alignment and its associated vegetation clearance zone would not be required. As a result, land outside the ROW would not need to be acquired in fee or easement for OCS alignment or ESZ purposes. In addition, this alternative would not construct the traction power supply substations in the City of South San Francisco and the City of San Jose. This alternative would not increase the demand or physically impact existing recreational facilities. The additional station platform areas would be within the Caltrain ROW and thus would not displace any other land uses.

Therefore, this alternative would have less impact on land use and recreation than the Proposed Project and would have the same impacts as the No Project Alternative.

Noise and Vibration

Operation of the DMUs would generate higher levels of engine noise than the Proposed Project EMUs. The DMU Alternative would also result in increased horn noise due to increased Caltrain service, primarily in peak hours, which would be the same horn noise increase as the Proposed Project and more train horn noise than the No Project Alternative. The DMU Alternative would not generate new noise associated with the TPFs. Because the DMU engines are slightly noisier than the EMUs, while the changes in train horn noise would be the same, the DMU Alternative would have greater noise impacts than the Proposed Project along the Caltrain ROW, but less impact around the TPFs. The DMU engines are slightly quieter than diesel locomotives, but with the additional horn noise, the DMU Alternative would have slightly higher noise levels overall than the No Project Alternative.

As presented in Table 5-9 ~~5-5~~, the following conclusions can be made for the 49 study locations for the DMU Alternative relative to the No Project Alternative in 2020.

- Noise levels lower than No Project Alternative: 5 ~~nine~~ study locations
- No change between No Project Alternative and the DMU Alternative: No ~~two~~ locations
- Noise levels higher with the DMU Alternative: 44 ~~38~~ locations.

Based on Table 5-9 ~~5-5~~, the following conclusions can be made for the 49 study locations for the DMU Alternative relative to the Proposed Project in 2020.

- Noise levels lower than the Proposed Project: No study locations
- No change between DMU Alternative and the Proposed Project: ~~four~~ No study locations
- Noise levels higher with the DMU Alternative: 49 ~~45~~ locations.

Therefore, this alternative would have a greater impact on sensitive receptors from noise than the Proposed Project and the No Project Alternative. However, as shown in Table 5-9 ~~5-5~~, like the Proposed Project, the DMU Alternative would not result in any exceedances of the FTA Criteria.

Vibration impacts of the DMUs should be similar to the Proposed Project, but the FRA-compliant DMUs would likely have slightly greater vibration than the EMUs, and the non-FRA-compliant DMUs would have similar vibration characteristics as the EMUs. As discussed in Section 3.11, *Noise and Vibration*, the EMUs are not expected to have significantly different vibration characteristic than existing conditions, so the differences between alternatives for operational vibration are not substantial.

Table 5-9 ~~5-5~~. Noise Levels and Impacts from Train Operation, DMU Alternative (2020)

Receptor Site No.	City	Cross Streets	Side of Alignment	Land Use[a]	Distance to Receptor (feet)	Measurement Site ID	Existing[b]	Proposed Project	DMU Alternative	Change with DMU over Existing	FTA Impact Criteria	
							Total Ambient Noise Exposure at Receptor[c] L_{dn} (dBA)				Moderate (dBA)	Severe (dBA)
1	San Francisco	Oakdale Ave and Quint Ave	W	MFR	110	N32	69	68.8	69.1	0.1	1.1	2.9
2	San Francisco	Reddy St and Williams Ave	E	SFR	80	N33	70	69.7	70.2	0.2	1.0	2.8
3	San Francisco	Carr St and Paul Ave	E	SFR	90	N32	70	69.7	70.1	0.1	1.0	2.8
4	San Francisco	Tunnel Ave and Lathrop Ave	E	SFR	120	N31	69	68.9	69.2	0.2	1.1	2.9
5	San Bruno	Herman St and Tanforan Ave	W	SFR	110	R05	76	75.4	75.6	-0.4	0.3	2.1
6	San Bruno	Huntington Ave and San Bruno Ave	E	MFR	50	R07	77	74.6	75.0	-2.0	0.3	2.0
7	San Bruno	Montgomery Ave and Walnut St	W	SFR	120	R07	74	72.3	72.6	-1.4	0.5	2.3
8	San Bruno	1st Ave and Pine St	E	SFR	100	N53	74	71.6	71.9	-2.1	0.5	2.3
9	San Bruno	Huntington Ave and Sylvan Ave	W	SFR	150	N53	72	69.5	69.9	-2.1	0.8	2.5
10	San Bruno	San Antonio Ave and San Benito Ave	W	SFR	170	N26	67	66.8	67.1	0.1	1.2	3.2
11	Millbrae	Monterey St and Santa Paula Ave	E	MFR	160	N25	71	71.0	71.2	0.2	1.0	2.6
12	Millbrae	Hemlock Ave and Hillcrest Blvd.	W	SFR	90	R12	72	72.0	72.2	0.2	0.8	2.5
13	Burlingame	California Dr and Dufferin Ave	W	SFR	150	N50	68	67.8	68.1	0.1	1.2	3.1
14	Burlingame	California Dr and Mills Ave	W	SFR	160	R14	70	70.1	70.2	0.2	1.0	2.8
15	Burlingame	California Dr and Palm Dr	W	SFR	190	N22	70	70.0	70.1	0.1	1.0	2.8
16	Burlingame	Park Ave and Carolan Ave	E	SFR	160	N22	71	71.0	71.2	0.2	1.0	2.6
17	San Mateo	Grand Blvd and San Mateo Blvd	W	SFR	40	R18	76	76.0	76.3	0.3	0.3	2.1
18	San Mateo	Railroad Ave and Monte Diablo	E	SFR	70	R18	72	71.9	72.3	0.3	0.8	2.5
19	San Mateo	B St and 9th Ave	W	MFR	110	N47	73	73.1	73.2	0.2	0.6	2.4
20	San Mateo	South Blvd and 16th Ave	W	SFR	85	N20	67	66.5	67.3	0.3	1.2	3.2
21	San Mateo	Pacific Blvd and Otay Ave	E	SFR	100	N19	72	71.9	72.2	0.2	0.8	2.5
22	San Mateo	Country Rd and Dale View Ave	E	MFR	120	R22	70	69.7	70.2	0.2	1.0	2.8
23	Belmont	Country Rd and Marine View	E	MFR	120	N18	73	72.9	73.2	0.2	0.6	2.4
24	San Carlos	Country Rd and Springfield Ave	E	SFR	100	N17	70	70.0	70.3	0.3	1.0	2.8
25	Redwood City	D St and Stafford St	E	SFR	90	N16	73	73.1	73.3	0.3	0.6	2.4
26	Redwood City	Cedar St and Main St	E	SFR	50	N47	76	76.0	76.3	0.3	0.3	2.1

Receptor Site No.	City	Cross Streets	Side of Alignment	Land Use[a]	Distance to Receptor (feet)	Measurement Site ID	Existing[b]	Proposed Project	DMU Alternative	Change with DMU over Existing	FTA Impact Criteria	
							Total Ambient Noise Exposure at Receptor[c] L_{dn} (dBA)				Moderate (dBA)	Severe (dBA)
27	Redwood City	198 Buckingham Ave	W	MFR	110	R27	69	68.6	69.2	0.2	1.1	2.9
28	San Mateo County	Arrowhead Lane and 5th Ave	E	SFR	50	N14	72	71.6	72.2	0.2	0.8	2.5
29	Atherton	Lloyden Dr and Fair Oaks Lane	W	SFR	60	N13	70	69.7	70.4	0.4	1.0	2.8
30	Atherton	Felton Dr and Encinal Ave	E	SFR	65	N13	70	69.7	70.3	0.3	1.0	2.8
31	Menlo Park	Burgess Dr and Alma St	E	MFR	175	N45	67	66.8	67.1	0.1	1.2	3.2
32	Palo Alto	Mitchell Lane and University Ave	W	MFR	100	N44	68	67.7	68.3	0.3	1.2	3.1
33	Palo Alto	Alma St and Lincoln Ave	E	SFR	120	N42	69	68.6	69.2	0.2	1.1	2.9
34	Palo Alto	Residences near Peers Park	W	SFR	40	R34	72	71.5	72.3	0.3	0.8	2.5
35	Palo Alto	Alma St and El Dorado Ave	E	MFR	160	N10	76	75.6	75.7	-0.3	0.3	2.1
36	Palo Alto	4237 Park Blvd	W	SFR	50	R36	78	78.1	78.2	0.2	0.2	1.8
37	Mountain View	Central Exp and Thompson Ave	E	SFR	150	N9	75	74.7	74.7	-0.3	0.4	2.2
38	Mountain View	Evelyn Ave and Bryant St	W	MFR	110	N8	73	72.7	72.8	-0.2	0.6	2.4
39	Mountain View	Central Exp and Whisman Ave	E	SFR	150	N39	72	71.9	72.0	0.0	0.8	2.5
40	Mountain View	S. Bernardo Ave and Evelyn Ave	E	SFR	75	N7	68	67.4	68.3	0.3	1.2	3.1
41	Sunnyvale	Asilomar Ave and Mary Ave	E	MFR	80	N7	70	69.8	70.2	0.2	1.0	2.8
42	Sunnyvale	332 Angel Ave	E	SFR	80	N6	71	70.9	71.2	0.2	1.0	2.6
43	Sunnyvale	Fair Oaks Ave and Evelyn Ave	W	MFR	75	N6	71	70.8	71.1	0.1	1.0	2.6
44	Santa Clara	Agate St and Lawrence Exp	W	MFR	85	R44	71	71.0	71.3	0.3	1.0	2.6
45	Santa Clara	Agate Dr and Bowers Ave	W	SFR	110	N4	68	67.7	68.2	0.2	1.2	3.1
46	Santa Clara	Alvarado Dr and San Thomas Exp	W	SFR	95	N37	68	67.6	68.2	0.2	1.2	3.1
47	Santa Clara	2109 Main St	W	SFR	95	N3	68	67.6	68.2	0.2	1.2	3.1
48	San Jose	782 Auzerais Ave	W	SFR	60	R48	81	81.0	81.0	0.0	0.1	1.0
49	San Jose	456 Jerome St	E	SFR	50	R49	71	70.1	70.5	-0.5	1.0	2.6

Source: Appendix C, *Noise and Vibration Technical Report*

[a] SFR = Single-Family Residence; MFR = Multi-Family Residence

[b] Existing total noise exposure based on representative noise measurement data (see Table 3.11-6).

[c] Project/Alternative total noise exposure is the result of combining future Caltrain noise with existing non-railroad noise and freight train noise, as in Table 3.11-6.

Population and Housing

This alternative would not indirectly or directly induce population growth or the demand for new housing units in the project area. Similar to the Proposed Project, operation of this alternative would not require the displacement of existing housing units or businesses. Therefore, the impact on population and housing would be the similar to the Proposed Project and the No Project Alternative.

Public Services and Utilities

With the DMU Alternative, operations would not have appreciable changes in public services demand, similar to the Proposed Project, and no effect on utility disruption. Thus, the Proposed Project, the No Project Alternative, and the DMU Alternative would all have similar effects on public services and utilities during operations.

Transportation/Traffic

Regional Traffic

Under the DMU Alternative, there would be an increase in rail service similar to the Proposed Project and more trains than with the No Project Alternative. Regionally, the DMU Alternative would result in a lesser reduction in VMT and associated general traffic congestion compared with the Proposed Project because the DMU Alternative's inferior performance relative to the Proposed Project's EMUs would result in less Caltrain ridership. However, the DMU Alternative would be beneficial compared with the No Project Alternative.

Localized Traffic at Certain At-Grade Crossings and Caltrain Stations

In comparison with the Proposed Project, the ridership under this alternative would be somewhat less. DMUs can travel just as fast at speed as the proposed EMUs in the corridor, but cannot accelerate ~~and decelerate~~ as fast as the proposed EMUs which will mean that either less stops can be serviced or overall travel times would be less, either of which will lessen ridership.

The DMU Alternative would likely result in a similar number of gate-down events during peak hours at the at-grade crossings as the Proposed Project. At at-grade crossings that are not near stations, the gate-down time should be similar to the Proposed Project. At at-grade crossings that are near stations, the DMU Alternative would result in greater gate-down time than the Proposed Project due to the slower ~~deceleration and~~ acceleration performance of DMUs compared with EMUs. Thus, at at-grade crossing near stations, the DMU alternative would have a greater impact on localized traffic than the Proposed Project would have.

Since the DMU alternative would result in less ridership than the Proposed Project, traffic levels near Caltrain stations may be somewhat less in general. However, at certain locations (Burlingame, San Mateo, Mountain View, and Sunnyvale) there could be issues with nearby cross-streets and localized traffic circulation could be more affected with this alternative at these locations. Given these offsetting impacts, the DMU Alternative is likely to result in similar localized traffic impacts to the Proposed Project.

Relative to the No Project Alternative, the DMU Alternative would result in better regional traffic and worse localized traffic at some at-grade crossings and near Caltrain stations.

Ridership of Other Transit Systems

The DMU Alternative would result in less Caltrain ridership than the Proposed Project. Similar to the Proposed Project, this alternative would not substantially change the ridership of other transit systems compared with the No Project Alternative

Conflict with other Transit Projects

The DMU Alternative, like the No Project Alternative, would avoid any potential OCS-related conflicts with the 22-Fillmore Project or DTX. However, the DMU Alternative is incompatible with the designs for DTX and TTC and, thus, would not allow a downtown extension of Caltrain as planned, which is a major conflict given that the extension is one of the driving rationales for DTX and TTC.

The Proposed Project's impacts related to the OCS for other transit projects are either less than significant or can be managed with mitigation. The Proposed Project is consistent with DTX and TTC designs; therefore, the DMU Alternative would have more conflict with other transit projects than the Proposed Project would have.

Pedestrian/Bicycle Facilities

As discussed in Section 3.14, *Transportation and Traffic,* the Proposed Project would have a less than significant impact on pedestrian facilities with mitigation. Since ridership would increase with the DMU Alternative, but less than with the Proposed Project, the DMU Alternative would have a smaller less than significant impact (with mitigation) on pedestrian facilities.

As discussed in Section 3.14, *Transportation and Traffic* and Section 4.1, *Cumulative Impacts*, the Proposed Project would result in an increased demand for bike facilities, but proposed mitigation would address this increased demand. There would also be an increase in demand for bike facilities with the increased ridership expected with the DMU Alternative; however, Caltrain could address this demand by similar means as the proposed mitigation for the Proposed Project. Thus, the DMU Alternative would have a lesser impact than the Proposed Project relative to bicycle facilities.

Because of greater ridership, this alternative would have more impact on existing pedestrian and bicycle facilities than the No Project Alternative would have.

Station Parking and Access

As discussed in Section 3.14, *Transportation and Traffic* and Section 4.1, *Cumulative Impacts*, the Proposed Project would result in an increased demand for parking, but this would not result in significant secondary impacts on air quality, noise, or traffic or due to the construction of other parking facilities. The DMU Alternative would result in a lower increase in parking demand and, therefore, would have less impact than the Proposed Project relative to parking demand.

Because of greater Caltrain ridership, this alternative would have more impact on station parking and access than the No Project Alternative would have.

Emergency Vehicle Access

Relative to emergency vehicle access, the DMU Alternative would have a similar but smaller positive effect on reducing regional vehicle miles traveled, a similar but worse adverse effect at at-grade crossing, and similar but smaller adverse effects at intersections near stations. This alternative would have similar but fewer overall beneficial impacts on emergency response times than the Proposed Project would have.

This alternative would be beneficial relative to the No Project Alternative.

Freight Rail Operations

As discussed in Chapter 2, Caltrain now considers that temporal separation will not be required for the mixed operation of alternative compliant EMUs with freight equipment on the Caltrain Corridor because alternative compliant equipment can provide an equivalent level of safety to the Tier 1 passenger vehicle safety requirements particularly in light of the new FRA rule-making underway. Similarly, alternative compliant DMUs should also be able to share operations with freight equipment without the need for temporal separation. In fact, the Denton County Transportation Authority received authorization to operate alternative compliant DMUs on the same tracks as freight operations from the FRA without temporal separation. Thus, like the Proposed Project, the DMU Alternative would not require substantial change in the freight operational window.

~~Use of light-weight DMUs may require the same temporal separation requirements for freight as the Proposed Project's EMUs and, thus, may have the same effect on freight operations. Use of heavier FRA-compliant DMUs would allow for freight trains to operate between the current 8 p.m. and 5 a.m. period, compared with midnight to 5 a.m. under the Proposed Project (presuming the project must comply with the temporal separation requirements in the FRA waiver and the waiver requirements are not altered in the future).~~

The DMU Alternative would not require an OCS, and, thus, there would be no concerns about potential height restrictions for freight. The Proposed Project would provide adequate height clearance for existing freight service. As discussed in Section 4.1, *Cumulative Impacts*, future freight trains could be slightly constrained to the existing freight train equipment heights. But even with limited freight diversion to other modes (such as trucks), this constraint is not likely ~~expected~~ to result in significant secondary physical impacts on the environment but is disclosed as potentially resulting in localized noise or traffic impacts in the event that some diversion to freight traffic would occur due to the change in OCS heights. The DMU Alternative would avoid any such impacts because it would not restrict overhead heights along the Caltrain ROW.

Overall, this alternative would have the same impacts as the No Project Alternative. ~~if FRA-compliant DMUs were used, but would have worse impacts than the No Project Alternative if light-weight DMUs were used.~~

5.2.3 Dual-Mode Multiple Unit (Dual-Mode MU) Alternative

As explained in Section 5.4, *Alternative Screening Process*, below, the Dual-Mode MU Alternative is considered feasible, would avoid or substantially reduce one or more significant impacts of the Proposed Project, and would meet some, but not all, of the project's purpose and need.

The Dual-Mode MU Alternative would not meet the project's purpose to provide electrical infrastructure compatible with high-speed rail. ~~This purpose is fundamental to the project, especially given that the primary source of funding for the project's construction would be Proposition 1A high-speed rail bond funds. Because this alternative fails to meet this fundamental purpose, the JPB could decide not to analyze it in this EIR.~~

In addition, while the increased train service under this alternative would increase revenue, this alternative would also increase diesel fuel consumption compared with existing conditions,[5] which would increase operating fuel costs. This alternative also would have lower ridership than the

[5] As explained above, the eight-car DMU Alternative would have higher fuel consumption compared with today's diesel locomotive five-car consists. Fuel consumption for a dual-mode MU has not been determined. Assuming a 10-car train and assuming dual-mode MUs would likely be heavier than corresponding DMUs due to the need for dual-mode equipment fuel consumption is likely to be more for the Dual-Mode MU Alternative than for the DMU Alternative when running in diesel mode (which would be the dominant operating mode for the Dual-Mode MU Alternative except in the DTX and TTC).

Proposed Project would have due to a slower acceleration profile. Therefore, this alternative would only partially meet the project's objective ~~purpose and need~~ to increase operating revenue and would not meet the objective to reduce operating fuel costs. ~~However, there has been community interest, expressed most recently in scoping comments, in the analysis of a Dual-Mode MU Alternative and, thus, the JPB decided to provide this alternative analysis for informational purposes.~~

A dual-mode multiple unit is a self-propelled vehicle that can operate in both a diesel mode and in an electrified mode. While there are dual-mode locomotives in operation on the East Coast, there are no known dual-mode MUs in operation in the United States at present. However, there are dual-mode MUs in operation and in construction in Europe that can operate in both a diesel mode and using an overhead 25 kVA OCS.

Dual-mode MUs have been in operation for approximately the last 10 years in Europe. ~~are a relatively recent technology and thus do not have a long track record by which to evaluate reliability and maintenance requirements.~~ Operational experience with some dual-mode locomotives ~~and trolleybuses~~ in the U.S. has shown reliability concerns. Based on 2010 data, the Long Island Railroad's (LIRR) dual-mode locomotives are the most unreliable pieces of equipment in their revenue vehicle fleet. For the same period, the LIRR single-level EMUs were the highest performers or most reliable equipment and have a Mean Distance Between Failures of about 300,000 miles versus only about 18,000 miles for the dual-mode locomotives. No data on the reliability of European Dual-Mode MUs was located. ~~A reliability concern with dual-mode transit equipment was also found in Seattle's recently retired dual-mode diesel/electric trolleybus suburban express fleet. King County Metro later removed the diesel engines and relegated these units to exclusive trolleybus use on electrified trunk routes in the city. The dual-mode buses were ultimately replaced on the suburban express bus routes by more conventional articulated hybrid buses (Tumola, Pers. Comm).~~ However, for the purposes of this analysis, Dual-Mode MUs are considered sufficiently reliable to support project purposes.

Similar to the DMU Alternative, the diesel engines in dual-mode MUs can burn low sulfur diesel fuel and would meet state and federal air quality standards. Depending on operational modes, dual-mode MUs have been reported to have 10 to 20 percent lower emissions (Alstom 2013a) and to use approximately 15 to 30 percent less energy than diesel locomotives (Alstom 2012; Railway Gazzette 2013b). Dual-Mode MUs would also meet the USEPA Tier 4 emission standards.

The key characteristics for this alternative related to desired service improvements is the reduction of running times due to faster acceleration than traditional push-pull service. Limited data on dual-mode MUs was located on acceleration rates. One source (Railway Gazzette 2007) cites initial acceleration for a Bombardier four-car, 240-foot dual-mode multiple unit with up to 220 passenger capacity as 1.1 mph per second for diesel mode and 1.5 mph per second for 25 kVA electric mode (compared with approximately 0.5 mph per second for conventional push-pull service, 1.4 mph per second for DMUs and 2.1 mph per second for EMUs). However, the specifications for the new Super Express Class 800s being developed for use in the U.K., indicate that dual-mode MU consists up to 10 vehicles can have initial acceleration rates of 1.7 mph per second (Agility 2009). The acceleration rates for the 10-car dual-mode MU presumed in this analysis (see discussion below) is unknown but for the sake of this analysis is presumed to be 1.7 mph per second which is substantially better than current diesel locomotives.[6]

[6] If this assumption is incorrect, then this alternative could still increase ridership, but the gains would be limited given the inability to add stops without slower overall travel times.

For the purposes of this alternative analysis, existing European train designs[7] were used to derive alternative assumptions:

- A 10-car single-level dual-mode MU train, consisting of two coupled five-car train sets, with a capacity of 600 passengers per train was analyzed in order to analyze an alternative that would roughly match the passengers per train capacity of the Proposed Project.
- The 10-car single-level dual-mode MU train length would be 600 feet which would ~~fit at existing Caltrain station platforms.~~ require lengthening at some of the Caltrain platforms including the platforms at 22nd Street, Broadway, California St., Sunnyvale, and Santa Clara.
- It was assumed that the Caltrain service schedule for the Dual-Mode MU Alternative would be the same as the Proposed Project but with lower ridership. Dual-mode MUs do not accelerate ~~or decelerate~~ as fast as EMUs and thus the number of station stops ~~steps~~ would likely have to be reduced to maintain the same trip time as the Proposed Project EMUs or travel times would be ~~less~~ greater.
- This alternative does not include electrification between San Jose and San Francisco. However, the DTX project has been planned assuming that the Caltrain electrification project would provide the traction power facilities to provide electrical power to the electrical train lines in the DTX ~~tunnel~~ and the TTC. Thus, this alternative would need to include traction power facilities to link the electrified lines in DTX to power from PG&E. This would involve connecting overhead or underground transmission wires from PG&E to a new traction power substation, and connecting transmission lines from the new traction power substation to the OCS for the DTX. Given the DTX and TTC location, the traction power substation would be in San Francisco, but the location is unknown. The traction power substation and transmission lines would be similar to those described for the Proposed Project.
- This Alternative is assumed to operate in a diesel mode from Tamien Station in San Jose to San Francisco and then either terminate at the San Francisco 4th and King Station or proceed in an electric mode to the TTC. In 2020, this alternative, like the Proposed Project would terminate at the 4th and King Station. In 2040, this alternative is presumed to operate with split service with four trains terminating at the 4th and King Station and two trains proceeding to TTC.

~~No specific cost estimate was prepared for this alternative.~~ This alternative would have much lower construction costs associated with the TPFs and OCS compared with the Proposed Project because this alternative would only require traction power facilities in San Francisco to connect to the DTX facilities and not the entire 51-mile corridor. ~~Maintenance and~~ Fuel costs ~~over this alternative's lifetime~~ would be ~~similar to or~~ higher than under the Proposed Project.

~~The assumptions above are based on FRA Alternative Compliant light-weight vehicles and thus the dual-mode MUs would not operate south of Tamien station and diesel locomotives would be used for service to Gilroy (as with the Proposed Project).~~

Relative to ridership, this alternative is assumed to result in less ridership than the Proposed Project due to the inferior acceleration~~/decelerations~~ performance of dual-mode MUs compared to EMUs. While service would increase to six trains pphpd, either the travel time would be longer or there

[7] This alternative is based on the Alstom Coradia Polyvalent platform, which is a dual-mode MU that is presently described as available in 3-car, 4-car and 6-car trainsets. To provide a comparable alternative to the Proposed Project, it was assumed that 5-car trainsets (300 feet, 300 passengers) would be built that would be intermediary between the 4-car trainsets (236 feet, 228 passengers) and the 6-car trainsets (360 feet, 366 passengers) (Alstom 2013a, 2013b). It is also assumed that a 5-car trainset could be coupled to provide a 10-car train (600 feet, 600 passengers) like the coupling of 3-car, 4-car, and 6-car trainsets that is feasible with current designs (Alstom 2013a and 2013b). Alstom has been building dual-mode MUs for SNCF and some entered service in 2013 with more planned. Bombardier has also been building dual-mode MUs for a number of years.

would be fewer stations served with this alternative compared with the Proposed Project. Both reduced station stops and longer travel times would affect ridership. While ridership was not modelled for this alternative, ridership is presumed to be somewhat less than under the Proposed Project but more than under the No Project Alternative due to the increased service. Nevertheless, the analysis of air quality and GHG emissions below, have assumed that the ridership would be the same as the Proposed Project, to provide a favorable comparison for the potential of this alternative.

The Dual-Mode MUs could also be used for service to Gilroy since they can be run in diesel mode. In a scenario in which Dual-Mode MUs were used in combination with full electrification (see discussion below), they could be used for one-seat transit from Gilroy to TTC. Dual-Mode MUs can also be converted to EMU only through removal of the diesel power packs during scheduled maintenance events. This alternative is also resilient through power outages as it could always operate in diesel mode. At terminals, all of the power packs onboard could be shut down and the train put on idle power from the terminal.

For this EIR, this alternative is envisioned as an alternative to avoid the Proposed Project impacts of the OCS such as aesthetics and tree removal, while still allowing service to reach TTC in the long run and thus does not include electrification between San Jose and San Francisco. However, there are other variations on this alternative in concept:

- Electrification in phases over a longer period of time if necessary to incrementally electrify instead of electrify the entire corridor at once. This is a feasible scenario in which Dual-Mode MUs could be used to provide end to end service while the corridor is electrifies over a longer period of time than proposed under the PCEP. However, at the end of the day, once the full OCS system is constructed, the impacts of this variant would have the same OCS impacts as the Proposed Project.
- Electrification of only a portion of the San Jose to San Francisco route to reduce OCS impacts: Given that the heaviest impacts of tree removals start at Atherton and head south (there would still be substantial tree removal impacts in cities like Burlingame and other north of Atherton) , one conceptual arrangement could have electrified territory from Redwood City to San Francisco (~27 miles) and non-electrified territory from Tamien to Redwood City (~24 miles). With this configuration, there would only be one changeover of power modes in the middle of the route and there could be a contiguous OCS system from Redwood City north. There would likely be a need for a full substation in Redwood City, but the rest of the configuration northward would be similar to the proposed project.
- Electrification of only a short segment near each station to provide for electrified acceleration while operating in diesel mode outside of near the stations to reduce OCS impacts:
    - To the JPB's knowledge, Dual-Mode MUs have never been used in this "start-stop" fashion anywhere in the world. Instead, Dual-Mode MUs are used to cover routes that have contiguous areas of electrified and non-electrified territory. For example, dual-mode locomotives are used to access several train stations in New York City using electrical power and then operate in diesel mode for areas outside the stations tunnels.
    - In concept, if one wanted to provide electric power for acceleration out of every station on the entire route, this could require 26 separate OCS segments on either side of each station between Tamien and SF 4th and King (not counting the Stanford station which is only used infrequently).
    - There are a number of critical issues with the design of such an alternative:
        - Length of the OCS segments is not likely to be short. Many Caltrain stations are relatively close together. From South San Francisco to Tamien, none of the stations are more than 3 miles apart and many are much closer, such as the Menlo Park and Atherton stations

which are only 1.1 miles apart. Even under electric power, trains do not reach their top speed immediately. Based on the EMU acceleration performance, it will likely take 50 to 60 seconds to reach top speed, during which time the EMU could cover perhaps 0.3 miles. In order to preserve the ability to operate service on either line (if one is out for maintenance or due to a train issue), each station would need a minimum of 0.6 miles of OCS on both tracks (perhaps 0.3 miles in each direction). Thus, between Menlo Park and Atherton, for example, the OCS associated with both stations would take up 0.6 miles between the two, leaving perhaps 0.5 miles without an OCS.

- While an electric motor can be ramped up to power nearly instantaneously, a large diesel engine cannot. Thus, in order to provide seamless power after the initial acceleration, the diesel would need to be running in a standby mode before it is called on to take the load. Further, by running both electricity and standby diesel, the efficiency is worsened. This would increase fuel consumption, air pollutant emissions and GHG emissions compared to EMU operations.
- Discontinuous OCS segments would either require substations for each short electrified segment with separate power drops from PG&E (requiring more transmission lines through adjacent communities or would require undergrounding of the live wires between the OCS segments in buried power conduit along the ROW with the current configuration of TPFs.

- For the reasons above, the "start-stop" configuration with short distances of electric mode and short distances of diesel mode would be highly inefficient and would not be cost effective as one would still need a "full" OCS if the electrified segments were distributed from San Jose to San Francisco.

While there are a myriad of permutations of this alternative, using the conceptual alternative defined above with about half of the route electrified, the partial electrification variation of the alternative would have impacts that would be somewhere in between that of the Proposed Project and the Dual-Mode Multiple Unit Alternative described in the DEIR. Compared to the Dual-Mode Multiple Unit Alternative described in this EIR, the partial electrification variant would have higher aesthetic and tree removal impacts (due to an OCS system from Redwood City to San Francisco), lower criteria pollutant and GHG emission impacts (due to more use of electricity and less of diesel), possibly higher ridership (due to better acceleration from Redwood City to San Francisco), and lower noise impacts (due to electric operations from Redwood City to San Francisco). Compared to the Proposed Project, the partial electrification alternative would have lower aesthetic and tree removal impacts (due to no OCS system from San Jose to Redwood City, higher criteria pollutant and GHG emission impacts (due to less use of electricity and more use of diesel) and higher local pollution impacts from San Jose to Redwood City (due to diesel use instead of electric power use), lower performance and ridership (due to lower acceleration in both diesel and electrical modes compared to EMUs), and higher noise impacts (due to diesel operations from Redwood City to San Francisco).

As a result, the partial electrification variant of alternative is not an independent alternative, but an intermediary alternative between the Dual-Mode Multiple Unit Alternative analyzed in this EIR and the Proposed Project, with environmental impacts at somewhat of a mid-point between the two. As such, the partial electrification variant of this alternative does not actually widen the range of alternatives in the EIR, because the reader can already see clearly the differences between the "full" Dual-Mode Multiple Unit Alternative and the Proposed Project which shows the range and types of impacts that occur when switching from diesel to electric modes. As such, the partial electrification variant of this alternative is not analyzed further below.

Construction Impacts

The Dual-Mode MU Alternative's construction impacts would be limited to new traction power facilities to connect PG&E power to the DTX OCS and extension of platforms at five stations. It is presumed that transition to the DTX ~~tunnel~~ for trains shifting from diesel mode to electrified mode to reach the 4th and Townsend Station would occur at roughly the same location as the currently planned transition to separate tracks in the current DTX design north of 16th Street.

The DMU Alternative would have greater construction impacts at five Caltrain stations but would require no construction at other locations. Overall, the areas of disturbance would be far less with the DMU Alternative, but the intensity of construction at the five Caltrain stations for this alternative would be far higher. The following 5 stations have platforms that are less than 600 feet in length: 22nd Street, Broadway, California Avenue, Sunnyvale, and Santa Clara. Platform extension at Caltrain stations would require grading, excavation, pouring of concrete, and potential utility relocates. Because some of the stations are historic stations, care would need to be taken to avoid impacts on the historic features, similar to that required in placing the OCS facilities with the Proposed Project. There would also be temporary air emissions and noise at the construction locations. In addition, there could be temporary utility disruption if utilities are present in platform extension areas.

Overall, although the Dual-Mode MU Alternative would have greater impacts at five Caltrain stations than the Proposed Project, given the smaller overall area of effect, this alternative would have less construction-related impacts than the Proposed Project in all subject areas with the exception of historic resources. Because this project would require platform changes at the historic Santa Clara station, the Dual-Mode MU Alternative could have similar or potentially higher impacts on cultural resources than the Proposed Project at the Santa Clara station.

Overall, ~~even if limited areas of additional construction were necessary to facilitate an appropriate transition area~~, construction impacts would be far less than under the Proposed Project or the DMU Alternative but would be greater than under the No Project Alternative.

Operational Impacts

When operating in diesel mode, the Dual-Mode MU Alternative would have impacts similar to those of the DMU Alternative. Thus, the analysis above for the DMU Alternative is referenced where appropriate and differences with the DMU Alternative are highlighted.

Aesthetics

This alternative would result in no changes to existing visual aesthetics, except in relation to traction power facilities and transmission lines in San Francisco, and possibly resulting from limited track work along the Caltrain ROW on the approach to the 4th and King Street Station, around 16th Street in San Francisco as well as platform extensions at five stations.

Minor track and OCS work at the transition point would not have significant impacts on existing visual aesthetics at this location under I-280 along the existing Caltrain ROW. The visual impacts of a new traction power substation and transmission lines would depend on their location, which is unknown.

This alternative would require extension of platforms at five Caltrain stations, which would change the visual appearance of the affected stations with additional concrete platform areas. But with extended platforms, the change in visual appearance would likely be less than significant given it would be at-grade and can be designed to be consistent with the aesthetics of existing platforms. The Dual-Mode MU Alternative would result in fewer permanent impacts than the Proposed Project on aesthetics along the Caltrain ROW because there would be no need for tree removal and an OCS.

This alternative would have less aesthetic impacts than the DMU Alternative as it would not require platform extension but would have aesthetic impacts greater than the No Project Alternative.

Air Quality

Emissions resulting from this alternative are presumed to be similar to the DMU Alternative for 2020 since this alternative presumes diesel operations between San Jose and San Francisco 4th and King Station. The diesel engines on the Dual-Mode MUs should have similar performance as the diesel engines on the DMUs. Given the likely train length and the somewhat heavier weight of dual-mode MUs compared to DMUs, it is ~~probably~~ possible that train-related emissions of this alternative would be higher than the DMU Alternative. For 2040, this alternative ~~may~~ will likely have lower emissions than the DMU Alternative due to the higher ridership with access to TTC and the resultant VMT-related emissions reductions.

Based on the DMU Alternative, the Dual-Mode MU Alternative would have lower emissions than the No Project Alternative in 2020 for criteria pollutants other than NOx but would likely have lower emissions compared with the No Project Alternative when taking into account VMT reductions in 2040 with the service to TTC.

Similar to the DMU Alternative, in 2020, health risks resulting from the Dual-Mode MU Alternative would be similar to, but possibly slightly higher ~~less~~ than under the No Project Alternative due to slightly higher ~~lowered~~ PM emissions along the Caltrain ROW ~~but~~ and risks may be slightly higher in 2040 depending on the No Project Alternative replacement of locomotives over time.

As discussed above for the DMU Alternative, the effect of tree removal avoidance compared to the Proposed Project on particulate emissions and health risks and other emissions (such as pantograph wear emissions) is likely minimal and would not change the conclusions noted above. Therefore, in 2020 this alternative would have a greater impact on air quality than the Proposed Project and the DMU Alternative but less impact than No Project Alternative relative to certain pollutants and more impact relative to other pollutants. In 2040, this alternative would have a greater impact on air quality than the Proposed Project, less impact than the No Project Alternative, and likely less impact than the DMU Alternative.

Biological Resources

Similar to the DMU and No Project Alternatives, this alternative would avoid the need for expanded tree removal and pruning. There would likely be limited to no biological resource impacts due to new traction power facilities and transmission lines in San Francisco.

With the Dual-Mode MU Alternative, diesel and nitrogen emissions regionally would be less than the No Project Alternative and result in fewer related effects on biological resources than the No Project Alternative. However, diesel fuel consumption would likely be higher than the DMU Alternative and would be substantially higher than the Proposed Project.

Cultural Resources

Operation of this alternative would not impact archeological, cultural, or historical resources. Dual Mode MUs would operate within the existing Caltrain ROW and on the existing tracks, and would not require modifications or removal of existing historical structures. Therefore, operational impacts on cultural resources would be the same as the Proposed Project, the DMU Alternative and the No Project Alternative.

Electromagnetic Fields/Electromagnetic Interference

Operation of this alternative would not require an overhead OCS except at the DTX ~~tunnel~~ and at TTC and new transmission lines from PG&E to the DTX. The operation of this alternative would not increase the level of electromagnetic fields along the Caltrain corridor and project vicinity, or increase electromagnetic interference in this same area. Impacts along the DTX ~~tunnel~~ and at TTC would be the same as with the Proposed Project. New transmission facilities can be designed to maintain exposure limits within health thresholds. Therefore, the potential impacts associated with EMF and EMI would be less than under the Proposed Project, but slightly greater than under the DMU Alternative and the No Project Alternative because of the Dual-Mode MU Alternative's electrified operations along the DTX ~~tunnel~~ and at TTC.

Geology, Soils and Seismicity

Under this alternative, operation of the Caltrain service would be in the same project area as the Proposed Project and would expose structures and people to the same seismic, soil, and geologic hazards as the Proposed Project. Therefore, the exposure of risks associated with seismic, soil, and geologic hazards would be the same as the Proposed Project, the DMU Alternative and the No Project Alternative.

Greenhouse Gas Emissions and Climate Change

Compared with the No Project Alternative, the Dual-Mode MU Alternative would ~~likely~~ have greater Caltrain system emissions similar to the DMU Alternative. The greater emissions would result from the increase in service and from the decreased fuel efficiency of longer MU consists. However, the Dual-Mode MU Alternative would likely have lower overall emissions than the No Project Alternative overall when including lowered VMT-related emissions resulting from increased Caltrain ridership (using the assumptions noted above).

Compared with the DMU Alternative, this alternative would likely have slightly higher GHG emissions to 2020 with the likely lower efficiency of longer and heavier dual-mode MUs. However, for 2040, this alternative is likely to have lower GHG emissions overall compared to the DMU alternative when taking into account the additional ridership likely with access to TTC.

Operation of the dual-mode MUs operating primarily in a diesel mode would produce substantially more GHG emissions than would the electric engines of the Proposed Project EMUs. This conclusion takes into account both direct engine GHG emissions and indirect GHG emissions from electricity generation, and the lower ridership likely with this alternative compared with the Proposed Project because of the alternative's relatively inferior train performance.

Hazards and Hazardous Material

Similar to the DMU Alternative, compared with the No Project Alternative, this alternative would result in more Caltrain diesel fuel use due to increased train service and due to a lower fuel efficient than the diesel locomotives. However, because the Dual-Mode MU Alternative would increase ridership, the decreased regional handling of gasoline would likely offset the increased Caltrain handling of diesel in terms of risk of accidents and spillage overall resulting in similar impacts as the No Project Alternative.

Compared with the Proposed Project, the Dual-Mode MU Alternative would require much more handling and transfer of diesel fuel, which increases the potential for release of diesel. Therefore, this alternative would have greater impacts associated with the release of and exposure to hazardous materials compared than the Proposed Project.

Because this alternative would likely be less efficient than the DMU Alternative when running in diesel mode, this alternative would likely have greater diesel consumption and handling. However in 2040, this alternative would reduce regional VMT more than the DMU Alternative and thus would have lower gasoline handling.

Hydrology and Water Quality

Under this alternative, there would be limited changes in impervious space and stormwater runoff potential due to new traction power facilities. It is assumed that new facilities would likely be out of the 100-year floodplain in San Francisco. If facilities were built in the floodplain, they could be flood-proofed similar to those of the Proposed Project. This alternative would require more handling and transfer of diesel fuel than the Proposed Project, which would increase the potential for release of diesel that may affect water quality.

The areas of the Caltrain ROW and associated facilities potentially subject to flooding would remain mostly the same, as the additional platforms at five stations would all be at stations that are not in the 100-year floodplain. for tracks 1 and 2 at the San Francisco 4th and King Station, which is in the 100-year floodplain. The Proposed Project would place some new facilities into the 100-year floodplain that would be subject to flooding effects, but mitigation is available to reduce effects to a less-than-significant level. Both the Dual-Mode MU Alternative and the Proposed Project would have similar vulnerabilities to future flooding associated with sea level rise, but the Proposed Project would place slightly more facilities at risk than the Dual-Mode MU Alternative. Thus, the Dual-Mode MU Alternative would have less impact related to flooding than the Proposed Project.

The Dual-Mode MU Alternative would have slightly higher potential for diesel spills than the No Project Alternative due to greater diesel duel handling but less gasoline handling overall due to lowered regional VMT. These impact changes offset each other and, therefore, this alternative would have similar water quality impacts to the No Project Alternative related to potential fuel spills or leakage.

Relative to the DMU Alternative, this alternative would have less impervious space and likely similar potential for fuel spills (due to more diesel use but less gasoline consumption in the long run).

Land Use and Recreation

Under this alternative, the OCS alignment and its associated vegetation clearance zone would not be required. As a result, land outside the ROW would not need to be acquired in fee or easement for OCS alignment or ESZ purposes. This alternative would require a traction power substation in San Francisco, but it is probable that this facility would be placed in commercial or industrial areas and would not result in land use incompatibilities. This alternative would not increase the demand or physically impact existing recreational facilities. The additional station platform areas would be within the Caltrain ROW and thus would not displace any other land uses.

Therefore, this alternative would have less impact on land use and recreation than the Proposed Project. This alternative would have similar impacts as the DMU Alternative and the No Project Alternative.

Noise and Vibration

Operation of the dual-mode MUs would likely have similar noise impacts as the DMU Alternative but possibly slightly greater due to heavier vehicles. Noise impacts would be greater than under the Proposed Project.

The dual-mode MUs should be quieter than today's locomotives but train horn sounding would increase with increased service and thus noise levels may be less than or similar to the No Project Alternative~~Proposed Project~~.

Population and Housing

This alternative would not indirectly or directly induce population growth or the demand for new housing units in the project area. Similar to the Proposed Project and the DMU Alternative, operation of this alternative would not require the displacement of existing housing units or businesses. Therefore, the impact on population and housing would be the similar to the Proposed Project, the DMU Alternative and the No Project Alternative.

Public Services and Utilities

With this alternative, operations would not have appreciable changes in public services demand, similar to the Proposed Project and the DMU Alternative, and no effect on utility disruption. Thus, the Proposed Project, the DMU Alternative, the No Project Alternative, and the Dual-Mode MU Alternative would all have similar effects on public services and utilities during operations.

Transportation/Traffic

Regional Traffic

Under this alternative, there would an increase in rail service similar to the Proposed Project and the DMU Alternative, but with more trains than with the No Project Alternative. Regionally, the Dual-Mode MU Alternative would result in a lesser reduction in VMT and associated general traffic congestion compared with the Proposed Project because, like the DMU Alternative, the Dual-Mode MU Alternative would result in less ridership due to inferior performance relative to the Proposed Project's EMUs. However, the Dual-Mode MU Alternative would be beneficial compared with the No Project Alternative and would reduce regional traffic more than the DMU Alternative in 2040 with access to TTC.

Localized Traffic at Certain At-Grade Crossings and Caltrain Stations

In comparison with the Proposed Project, the ridership under this alternative would be somewhat less. Dual-mode MUs cannot accelerate ~~and decelerate~~ as fast as the proposed EMUs which will mean that either less stops can be serviced or overall travel times would be less, either of which will lessen ridership.

The Dual-Mode MU Alternative would likely result in a similar number of gate-down events during peak hours at the grade crossings as the Proposed Project. At grade crossings that are not near stations, the gate-down time should be similar to the Proposed Project. At grade crossings that are near stations, the Dual-Mode MU Alternative would result in greater gate-down time than the Proposed Project due to the slower ~~deceleration and~~ acceleration performance. Thus, at grade crossings near stations, the Dual-Mode MU Alternative, like the DMU Alternative, would have a greater impact on localized traffic than the Proposed Project.

Because the Dual-Mode MU Alternative would result in less ridership than the Proposed Project, traffic impacts near Caltrain stations may be somewhat less, like the DMU Alternative. On balance localized traffic impacts are likely to be similar to the Proposed Project.

Relative to the No Project Alternative, the Dual-Mode MU Alternative would result in better regional traffic and worse localized traffic at some at-grade crossings and near Caltrain stations.

Ridership of Other Transit Systems

The Dual-Mode MU Alternative would result in less Caltrain ridership than the Proposed Project. Similar to the Proposed Project and the DMU Alternative, this alternative would not substantially change the ridership of other transit systems compared with the No Project Alternative.

Conflict with other Transit Projects

The Dual-Mode MU Alternative would be consistent with plans for DTX and TTC. Regarding the rerouting of 22-Fillmore, there may be need for crossing design to ensure the pantograph of the dual-mode MUs would not contact the direct current trolley bus overhead line, which is a similar concern to the Proposed Project, depending on the location for transition from diesel to electrified service with this alternative relative to 16th Street. If no electrification were done at 16th Street, since this alternative can run in diesel mode, there would be no conflict with the 22-Fillmore OCS.

The Proposed Project's impacts related to the OCS for other transit projects are either less than significant or can be managed with mitigation, so this difference is not considered significant.

This alternative would be consistent with the plans for DTX and TTC which would be a lower impact than either the DMU Alternative or the No Project Alternative both of which would be in conflict.

Pedestrian/Bicycle Facilities

As discussed in Section 3.14, *Transportation and Traffic,* the Proposed Project would have a less than significant impact on pedestrian facilities with mitigation. Since ridership would increase with the Dual-Mode MU Alternative, but less than with the Proposed Project, this alternative would have a smaller less than significant impact (with mitigation) on pedestrian facilities. It would have a similar impact as the DMU Alternative.

As discussed in Section 3.14, *Transportation and Traffic* and Section 4.1, *Cumulative Impacts*, the Proposed Project would result in an increased demand for bike facilities, but proposed mitigation would address this increased demand. There would also be an increase in demand for bike facilities with the increased ridership expected with this alternative; however, Caltrain could address this demand by similar means as the proposed mitigation for the Proposed Project. Thus, the Dual-Mode MU Alternative would have a lesser impact than the Proposed Project relative to bicycle facilities.

Station Parking and Access

As discussed in Section 3.14, *Transportation and Traffic* and Section 4.1, *Cumulative Impacts*, the Proposed Project would result in an increased demand for parking, but this would not result in significant secondary impacts on air quality, noise, or traffic or due to the construction of other parking facilities. The Dual-Mode MU Alternative would result in a lower increase in parking demand and, therefore, would have less impact than the Proposed Project relative to parking demand.

Emergency Vehicle Access

Relative to emergency vehicle access, the Dual-Mode MU Alternative would have a similar but smaller positive effect on reducing higher regional vehicle miles traveled, a similar but worse adverse effect at at-grade crossing, and similar but smaller adverse effects at intersections near stations. This alternative would have similar but less overall beneficial impacts on emergency response times as the Proposed Project. This alternative would be beneficial relative to the No Project Alternative.

Freight Rail Operations

This alternative ~~would require the same temporal separation requirements for freight as the Proposed Project's EMUs and, thus,~~ would have the same effect on freight operations as the Proposed Project because it is presumed that alternative compliant dual-mode MUs could operate in a shared environment with freight trains, like the Proposed Project's EMUs.

This alternative would not require an OCS (outside of DTX/TTC); consequently, there would be no concerns about potential height restrictions for freight. Overall this alternative would have the same impacts as the DMU Alternative ~~(presuming light-weight DMUs),~~ less impacts than the Proposed Project (due to lack of OCS), and ~~more~~ similar impacts to ~~than~~ the No Project Alternative.

5.2.4 Tier 4 Diesel Locomotive Alternative (T4DL)

A Tier 4 Diesel Locomotive (T4DL) Alternative is feasible as new diesel locomotives are under construction in the U.S. that can meet the USEPA's Tier 4 emissions standards.

The T4DL Alternative would not meet the project's purpose to provide electrical infrastructure compatible with high-speed rail. In addition, while the increase train service under this alternative would increase revenue, this alternative would also increase diesel fuel consumption compared with existing conditions[8] which would increase operating fuel costs. Therefore, this alternative would only partially meet the project's objective to increase operating revenue and would not meet the objective to reduce operating fuel costs. In addition, as discussed below, this alternative would not lower engine noise compared to the No Project Alternative.

Although this alternative does not meet three of the project objectives, it was analyzed to respond to public interest. It should be noted that this alternative is actually an extension of the No Project Alternative. The No Project Alternative also uses Tier 4 Diesel Locomotives; the differences are that the Tier 4 Diesel Locomotive Alternative includes an increase to 114 trains per day and 6 trains per peak hour per direction, a change from the existing schedule to the Proposed Project schedule, and he T4DL-DH variant of this alternative would include two locomotives per consist. If this alternative were advanced, it would require no CEQA analysis, because CEQA exempts increases of passenger service on existing rail lines if it involves no new construction of new rail lines. As such, this alternative does not actually meaningfully expand the range of alternatives considered in the DEIR and it is not mandatory to analyze this alternative further. However, as noted above, due to public interest, this alternative is analyzed to respond to comments on the DEIR.

As indicated in Table 5-1, a new Tier 4 single diesel locomotive hauling passenger coaches would have initial acceleration rates of approximately 1.1 mphps and a train consist with two diesel locomotives would have an initial acceleration rate of approximately 2.1 mphps. The new Tier 4 diesel locomotives under construction by Siemens can reach up to 125 mph top speed and have a maximum deceleration of approximately 1.8 mphps (Siemens 2013) but the deceleration profile would be somewhat less than that of the EMUs as the passenger coaches would not have independent braking like the EMUs.

[8] 2020 No Project diesel consumption is estimated as 5.6 million gallons/year compared with 2020 T4DL Alternative diesel consumption of 6.5 to 9.2 million gallons/year (Single-head vs. double-head scenario). Nominal fuel consumption for a single T4 diesel locomotive is 3.6 gallons/mile (including non-revenue) compared to 3.1 gallons/mile (including non-revenue) for today's diesels, which are less powerful. Double-head scenario would have higher fuel consumption due to use of two locomotives per consist. As discussed in text, 2020 scenarios for the T4DL Alternative assume continued use of 1998 and 2003 remnant diesel locomotives until they reach the end of their service life to match the project's use of remnant diesel locomotives as well.

This alternative includes two variants: 1) a single-head (SH) scenario which includes operation of train consists with only one locomotive; and 2) a double-head (DH) scenario in which trains are operated with two locomotives.

Newer diesel locomotives would reduce running times due to faster acceleration than current Caltrain diesel equipment.

For the purposes of this alternative analysis in order to make "apples to apples" comparisons to the Proposed Project to contrast the consequences of using a different train technology, the following assumptions were made.

- Train consists would be the same as today with a single or double locomotive hauling 5 bi-level passenger coaches with a nominal capacity of 600 passenger seats per train order to analyze an alternative that would roughly match the ridership[9] per train capacity of the Proposed Project.
- It was assumed that the Caltrain service levels (6 trains per peak hour, 114 trains/weekday) would be the same as the Proposed Project.
- For 2020, the single-head scenario would likely not result in the same amount of ridership given the differences in both acceleration and deceleration as the proposed project and thus the number of stops during peak hours would have to be less than the Proposed Project and/or end to end trip times would be longer. For the sake of EIR analysis only, it was assumed that this scenario would have the same ridership as the PCEP, even though it would have inferior performance compared to the PCEP.
- For 2020, the double-head scenario would accelerate almost as fast as EMUs, Even though its deceleration profiles would be less than the EMUs, for the sake of the environmental analysis only, ridership is assumed to be the same as the PCEP.
- For 2020, both scenarios assume continued use of the remaining Caltrain diesel locomotives that are less than 30 years old including the three 1998 F40s and the six 2003 MP36s. this is the same assumption as for the PCEP, which will operate a mixed fleet in 2020.
- For 2040, both scenarios would presume 100 percent use of Tier 4 diesel locomotives.
- For 2040, the T4DL Alternative is assumed to terminate at the San Francisco 4th and King Station and would not proceed to the TTC because the DTX and the TTC are designed only for electric trains. Even if ventilation were added to the DTX tunnel, the TTC is a fully enclosed station that is not designed to handle the emissions from diesel train operations in the enclosed station. Many fully enclosed stations and tunnels, like the tunnels leading to Grand Central Station and Penn Station in New York City prohibit diesel operations due to health concerns. Other major downtown stations that allow diesel operations, such as Union Station in Chicago, face substantial controversy concerning diesel emissions in constrained spaces. Thus, due to the design of the DTX and the TTC and due to the health concerns about diesel emissions in enclosed spaces, this alternative does not include service to TTC.
- For 2040, two sub-scenarios were evaluated for ridership: one assuming 20% less ridership increase over the No Project ridership compared to the PCEP and one assuming the same ridership as the PCEP. This is to account for the potential differences due to not serving TTC compared to the PCEP.

Construction Impacts

This alternative would involve replacing the existing Caltrain diesel locomotive-hauled vehicles with new T4DL vehicles but would involve no new construction.

[9] The Proposed Project capacity is roughly 600 passenger seats per train.

Operational Impacts

Aesthetics

This alternative would not involve the installation of an OCS or TPFs or additional removal of vegetation. Current maintenance trimming of vegetation would continue as at present, but the maintained area would not change (with the Proposed Project the maintained area would expand outward as necessary for the OCS ESZ).

Overall, the T4DL Alternative would have substantially less aesthetic impact than the Proposed Project and the same impacts as the No Project alternative.

Air Quality

Emissions resulting from T4DL operations were compared with EMU operations emissions under the Proposed Project.

As noted above, no ridership evaluation was conducted for the T4DL Alternative. The single-head and double-head scenario were both assumed to have the same ridership as the PCEP in 2020. For 2040, two scenarios were studied: 1) assuming 80 percent of the ridership increase of the PCEP above the No Project conditions (due to not reaching TTC) and 2) assuming the same ridership as the PCEP.

As shown in Table 5-6 above, due to higher Caltrain diesel daily consumption, the T4DL Alternative would result in substantially higher daily emissions of ROG, CO, and NO_X and slightly higher emissions of PM10 and PM2.5 along the Caltrain ROW than the Proposed Project in both the 2020 project scenario and the 2040 fully electrified scenario. When taking into account the indirect electricity emissions and assuming the same ridership as the Proposed Project, the T4DL Alternative would still have substantially higher criteria pollutants in both the 2020 and 2040 scenarios. In 2020, the differences in NO_x emissions between the T4DL Alternative and the Proposed Project are well above the BAAQMD threshold. For 2040, assuming different ridership, the differences between The T4DL Alternative and the Proposed Project for ROG, NOx and PM10 would be above the BAAQMD threshold. For 2040, assuming the same ridership, the differences between the T4DL Alternative and the Proposed Project for NOx would be above the BAAQMD threshold.

Based on the PM10 emissions shown in Table 5-6, the T4DL Alternative would also have slightly higher DPM emissions associated with Caltrain diesel trains along the Caltrain ROW and would result in higher health risks associated with DPM for residents along the Caltrain ROW compared with the Proposed Project. Using the example provided in Section 3.2, *Air Quality*, of an area in Menlo Park proposed for mixed use where the current diesel locomotives would result in an indoor risk of cancer from DPM emissions of 39 in a million, and assuming that the health risks are directly proportionate to daily PM10 emissions, the cancer health risks associated with the T4DL Alternative would be 7 to 8 in a million in 2020 at the modeled location. As noted in Section 3.2, *Air Quality*, the Proposed Project would reduce the health risk at this location to approximately 5 in a million in 2020.

In 2020, the T4DL-DH Alternative would have lower Caltrain system emissions compared with the No Project Alternative for all criteria pollutants when taking into account VMT reductions. The T4DL-DH Alternative would have lower criteria pollutant emissions overall, except for NO_X emissions which would be higher than the No Project Alternative by more than the BAAQMD threshold. In 2040, the T4DL-DH Alternative would result in lower emissions compared with the No Project Alternative for all criteria pollutants.

In 2020, health risks resulting from the T4DL Alternative would be slightly higher than under the No Project Alternative due to slightly higher DPM emissions along the Caltrain ROW. The risks also

would be slightly higher in 2040 due to higher DPM emissions along the Caltrain ROW. But the differences are not significant and this alternative, like all of the alternatives would result in substantial reductions in DPM emissions compared to existing conditions.

As discussed above for the DMU Alternative, the effect of tree removal avoidance compared to the Proposed Project on particulate emissions and health risks and other emissions (such as pantograph wear emissions) is likely minimal and would not change the conclusions noted above.

Therefore, this alternative would have a greater impact on air quality than the Proposed Project but would have but a decreased impact overall compared with the No Project Alternative in the long run (e.g., with full replacement).

Biological Resources

With this alternative, existing tree trimming to maintain physical clearance zones for trains would continue but would not be expanded as in the Proposed Project. Thus, this alternative would have less ongoing disruption to nesting birds and bats that might be present in trees along the Caltrain ROW.

This alternative would have continued diesel emissions along the Caltrain ROW (higher than the Proposed Project), which would result in continued deposition of diesel contaminants into adjacent upland and aquatic areas. In addition, diesel emissions also result in nitrogen deposition (higher than the Proposed Project) adjacent to the Caltrain ROW and in areas a number of miles from the Caltrain ROW. As discussed in Section 3.3, *Biological Resources*, deposition of nitrogen from vehicle emissions and other emission sources has resulted in a "fertilization effect" in natural areas that has favored non-native species over some native species, in particular affecting habitat for host plants for certain rare butterfly species.

With the T4DL Alternative, diesel and nitrogen emissions regionally would be less than the No Project Alternative and thus this alternative would have fewer related effects on biological resources than the No Project Alternative.

Cultural Resources

Operation of this alternative would not impact archeological, cultural, or historical resources. T4DLs would operate within the existing Caltrain ROW and on the existing tracks, and would not require modifications or removal of existing historical structures. Therefore, operational impacts on cultural resources would be the same as the Proposed Project and the No Project Alternative.

Electromagnetic Fields/Electromagnetic Interference

Operation of T4DLs would not require an overhead OCS. Instead, the T4DLs would be powered by onboard diesel engines. The operation of this alternative would not increase the level of electromagnetic fields along the Caltrain corridor and project vicinity, or increase electromagnetic interference. Therefore, the potential impacts associated with EMF and EMI would be less than the Proposed Project and the same as the No Project Alternative.

Geology, Soils and Seismicity

Under this alternative, operation of the Caltrain service would be in the same project area as the Proposed Project and would expose structures and people to the same seismic, soil, and geologic hazards as the Proposed Project. Therefore, the exposure of risks associated with seismic, soil, and geologic hazards would be the same as the Proposed Project and the No Project Alternative.

Greenhouse Gas Emissions and Climate Change

Compared to existing conditions, the T4DL-SH Alternative in 2020 would result in lower GHG emissions but the T4DL-DH Alternative would result in a slight increase in GHG emissions. Boh variants of the T4DL Alternative would result in substantially lower GHG emissions in 2040 than under existing conditions.

The T4DL Alternative would result in greater GHG emissions overall than the Proposed Project but less overall than the No Project Alternative when taking into account all changes in emissions, including changes in VMT and associated passenger vehicle emissions.

Operation of the T4DLs would emit more GHG emissions than electric engines in the Proposed Project EMUs, taking into account both direct engine GHG emissions as well as indirect GHG emissions from electricity generation. The analysis used the same sensitivity approach to ridership as described above for the air quality analysis.

Compared with the No Project Alternative, the T4DL Alternative would have greater Caltrain system emissions. The greater emissions would result from the increase in service. However, the T4DL Alternative would have lower emissions than the No Project Alternative overall when including lowered VMT-related emissions resulting from increased Caltrain ridership (using the assumptions noted above).

Hazards and Hazardous Material

Under this alternative, there would be an ongoing potential for the release of and exposure to diesel fuel and other hazardous materials during maintenance activities. Operation of this alternative would also generate hazardous waste material from the use of lubricants and solvents.

Compared with the No Project Alternative, this alternative would result in more Caltrain diesel fuel use due to increased train service. However, because the T4DL Alternative would increase ridership and lower regional VMT, the decreased regional handling of gasoline would likely offset the increased Caltrain handling of diesel in terms of risk of accidents and spillage.

Compared with the Proposed Project, the T4DL Alternative would require much more handling and transfer of diesel fuel, which increases the potential for release of diesel. Therefore, this alternative would have greater impacts associated with the release of and exposure to hazardous materials compared than the Proposed Project but likely similar overall impacts as the No Project Alternative.

Hydrology and Water Quality

Under this alternative, there would be no change in impervious area in the project area. This alternative would not require the construction of TPFs or the OCS. This alternative would require much more handling and transfer of diesel fuel than the Proposed Project, which would increase the potential for release of diesel that may affect water quality. Because the Proposed Project's operational impact on water quality is readily addressed through application of existing regulations, and the Proposed Project would require far less handling of diesel fuel, the T4DL Alternative is considered to have a higher risk of spills and water quality effects than the Proposed Project.

The areas of the Caltrain ROW and associated facilities potentially subject to flooding would remain the same. The Proposed Project would place some new facilities into the 100-year floodplain that would be subject to flooding effects, but mitigation is available to reduce effects to a less-than-significant level. Both the T4DL Alternative and the Proposed Project would have similar vulnerabilities to future flooding associated with sea level rise, but the Proposed Project would place slightly more facilities at risk than the T4DL Alternative. Thus, the T4DL Alternative would have less impact related to flooding than the Proposed Project.

The T4DL Alternative would have the same impacts than the No Project Alternative relative to stormwater runoff and flooding. As described above, the T4DL Alternative would require greater diesel duel handling by Caltrain than the No Project Alternative but less gasoline handling overall due to lowered regional VMT. These impact changes offset each other and, therefore, this alternative would have similar water quality impacts related to potential fuel spills or leakage.

Land Use and Recreation

Under this alternative, the OCS alignment and its associated vegetation clearance zone would not be required. As a result, land outside the ROW would not need to be acquired in fee or easement for OCS alignment or ESZ purposes. In addition, this alternative would not construct the traction power supply substations in the City of South San Francisco and the City of San Jose. This alternative would not increase the demand or physically impact existing recreational facilities.

Therefore, this alternative would have less impact on land use and recreation than the Proposed Project and would have the same impacts as the No Project Alternative.

Noise and Vibration

Operation of the T4DLs would generate higher levels of engine noise than the Proposed Project EMUs. The T4DL Alternative would also result in increased horn noise due to increased Caltrain service, primarily in peak hours, which would be the same horn noise increase as the Proposed Project and more train horn noise than the No Project Alternative. The T4DL Alternative would not generate new noise associated with the TPFs. Because the T4DL engines are noisier than the EMUs, while the changes in train horn noise would be the same, the T4DL Alternative would have greater noise impacts than the Proposed Project along the Caltrain ROW, but less impact around the TPFs. The T4DL engines are slightly quieter than existing diesel locomotives, but with the additional horn noise, the T4DL-DH Alternative would have higher noise levels overall than the No Project Alternative.

As presented in Table 5-10, the following conclusions can be made for the 49 study locations for the T4DL-DH Alternative relative to No Project conditions.

- Noise levels lower than No Project Alternative: Four locations
- No change between No Project Alternative and the T4DL-DH Alternative: No locations
- Noise levels higher with the T4DL Alternative: 45 locations.

Based on Table 5-10, the following conclusions can be made for the 49 study locations for the T4DL-DH Alternative relative to the Proposed Project.

- Noise levels lower than the Proposed Project: No study locations
- No change between T4DL Alternative and the Proposed Project: No study locations
- Noise levels higher with the T4DL Alternative: 49 locations.

Therefore, this alternative would have a greater impact on sensitive receptors from noise than the Proposed Project and the No Project Alternative. As shown in Table 5-10, unlike the Proposed Project, the T4DL-DH Alternative would result in exceedances of the FTA Criteria at four locations and thus would result in a significant project-level noise impact whereas the Proposed Project would not.

Table 5-10. Noise Levels and Impacts from Train Operations, Tier 4 Diesel Locomotive Alternative – Double-Head Scenario (2020)

Receptor Site No.	City	Cross Streets	Side of Alignment	Land Use[a]	Distance to Receptor (feet)	Measurement Site ID	Existing[b]	Proposed Project	T4DL-DH Alternative	Change with T4DL over Existing	FTA Impact Criteria	
							Total Ambient Noise Exposure at Receptorc L_{dn} (dBA)				Moderate (dBA)	Severe (dBA)
1	San Francisco	Oakdale Ave and Quint Ave	W	MFR	110	N32	69	68.8	69.5	0.5	1.1	2.9
2	San Francisco	Reddy St and Williams Ave	E	SFR	80	N33	70	69.7	70.6	0.6	1.0	2.8
3	San Francisco	Carr St and Paul Ave	E	SFR	90	N32	70	69.7	70.5	0.5	1.0	2.8
4	San Francisco	Tunnel Ave and Lathrop Ave	E	SFR	120	N31	69	68.9	69.6	0.6	1.1	2.9
5	San Bruno	Herman St and Tanforan Ave	W	SFR	110	R05	76	75.4	75.7	-0.3	0.3	2.1
6	San Bruno	Huntington Ave and San Bruno Ave	E	MFR	50	R07	77	74.6	75.4	-1.6	0.3	2.0
7	San Bruno	Montgomery Ave and Walnut St	W	SFR	120	R07	74	72.3	72.9	-1.1	0.5	2.3
8	San Bruno	1st Ave and Pine St	E	SFR	100	N53	74	71.6	72.4	-1.6	0.5	2.3
9	San Bruno	Huntington Ave and Sylvan Ave	W	SFR	150	N53	72	69.5	70.4	-1.6	0.8	2.5
10	San Bruno	San Antonio Ave and San Benito Ave	W	SFR	170	N26	67	66.8	67.4	0.4	1.2	3.2
11	Millbrae	Monterey St and Santa Paula Ave	E	MFR	160	N25	71	71.0	71.3	0.3	1.0	2.6
12	Millbrae	Hemlock Ave and Hillcrest Blvd.	W	SFR	90	R12	72	72.0	72.4	0.4	0.8	2.5
13	Burlingame	California Dr and Dufferin Ave	W	SFR	150	N50	68	67.8	68.4	0.4	1.2	3.1
14	Burlingame	California Dr and Mills Ave	W	SFR	160	R14	70	70.1	70.4	0.4	1.0	2.8
15	Burlingame	California Dr and Palm Dr	W	SFR	190	N22	70	70.0	70.3	0.3	1.0	2.8
16	Burlingame	Park Ave and Carolan Ave	E	SFR	160	N22	71	71.0	71.3	0.3	1.0	2.6
17	San Mateo	Grand Blvd and San Mateo Blvd	W	SFR	40	R18	76	76.0	76.6	0.6	0.3	2.1
18	San Mateo	Railroad Ave and Monte Diablo	E	SFR	70	R18	72	71.9	72.6	0.6	0.8	2.5
19	San Mateo	B St and 9th Ave	W	MFR	110	N47	73	73.1	73.3	0.3	0.6	2.4
20	San Mateo	South Blvd and 16th Ave	W	SFR	85	N20	67	66.5	67.9	0.9	1.2	3.2
21	San Mateo	Pacific Blvd and Otay Ave	E	SFR	100	N19	72	71.9	72.5	0.5	0.8	2.5
22	San Mateo	Country Rd and Dale View Ave	E	MFR	120	R22	70	69.7	70.6	0.6	1.0	2.8

Receptor Site No.	City	Cross Streets	Side of Alignment	Land Use[a]	Distance to Receptor (feet)	Measurement Site ID	Existing[b]	Proposed Project	T4DL-DH Alternative	Change with T4DL over Existing	FTA Impact Criteria	
							Total Ambient Noise Exposure at Receptorc L_{dn} (dBA)				Moderate (dBA)	Severe (dBA)
23	Belmont	Country Rd and Marine View	E	MFR	120	N18	73	72.9	73.4	0.4	0.6	2.4
24	San Carlos	Country Rd and Springfield Ave	E	SFR	100	N17	70	70.0	70.6	0.6	1.0	2.8
25	Redwood City	D St and Stafford St	E	SFR	90	N16	73	73.1	73.4	0.4	0.6	2.4
26	Redwood City	Cedar St and Main St	E	SFR	50	N47	76	76.0	76.5	0.5	0.3	2.1
27	Redwood City	198 Buckingham Ave	W	MFR	110	R27	69	68.6	69.8	0.8	1.1	2.9
28	San Mateo County	Arrowhead Lane and 5th Ave	E	SFR	50	N14	72	71.6	72.7	0.7	0.8	2.5
29	Atherton	Lloyden Dr and Fair Oaks Lane	W	SFR	60	N13	70	69.7	70.9	0.9	1.0	2.8
30	Atherton	Felton Dr and Encinal Ave	E	SFR	65	N13	70	69.7	70.8	0.8	1.0	2.8
31	Menlo Park	Burgess Dr and Alma St	E	MFR	175	N45	67	66.8	67.4	0.4	1.2	3.2
32	Palo Alto	Mitchell Lane and University Ave	W	MFR	100	N44	68	67.7	68.7	0.7	1.2	3.1
33	Palo Alto	Alma St and Lincoln Ave	E	SFR	120	N42	69	68.6	69.7	0.7	1.1	2.9
34	Palo Alto	Residences near Peers Park	W	SFR	40	R34	72	71.5	73.0	1.0	0.8	2.5
35	Palo Alto	Alma St and El Dorado Ave	E	MFR	160	N10	76	75.6	75.7	-0.3	0.3	2.1
36	Palo Alto	4237 Park Blvd	W	SFR	50	R36	78	78.1	78.4	0.4	0.2	1.8
37	Mountain View	Central Exp and Thompson Ave	E	SFR	150	N9	75	74.7	74.8	-0.2	0.4	2.2
38	Mountain View	Evelyn Ave and Bryant St	W	MFR	110	N8	73	72.7	73.0	0.0	0.6	2.4
39	Mountain View	Central Exp and Whisman Ave	E	SFR	150	N39	72	71.9	72.1	0.1	0.8	2.5
40	Mountain View	S. Bernardo Ave and Evelyn Ave	E	SFR	75	N7	68	67.4	69.0	1.0	1.2	3.1
41	Sunnyvale	Asilomar Ave and Mary Ave	E	MFR	80	N7	70	69.8	70.6	0.6	1.0	2.8
42	Sunnyvale	332 Angel Ave	E	SFR	80	N6	71	70.9	71.6	0.6	1.0	2.6

Receptor Site No.	City	Cross Streets	Side of Alignment	Land Use[a]	Distance to Receptor (feet)	Measurement Site ID	Existing[b]	Proposed Project	T4DL-DH Alternative	Change with T4DL over Existing	FTA Impact Criteria	
							Total Ambient Noise Exposure at Receptorc L_{dn} (dBA)				Moderate (dBA)	Severe (dBA)
43	Sunnyvale	Fair Oaks Ave and Evelyn Ave	W	MFR	75	N6	71	70.8	71.5	0.5	1.0	2.6
44	Santa Clara	Agate St and Lawrence Exp	W	MFR	85	R44	71	71.0	71.6	0.6	1.0	2.6
45	Santa Clara	Agate Dr and Bowers Ave	W	SFR	110	N4	68	67.7	68.5	0.5	1.2	3.1
46	Santa Clara	Alvarado Dr and San Thomas Exp	W	SFR	95	N37	68	67.6	68.7	0.7	1.2	3.1
47	Santa Clara	2109 Main St	W	SFR	95	N3	68	67.6	68.7	0.7	1.2	3.1
48	San Jose	782 Auzerais Ave	W	SFR	60	R48	81	81.0	81.1	0.1	0.1	1.0
49	San Jose	456 Jerome St	E	SFR	50	R49	71	70.1	71.6	0.6	1.0	2.6

Source: Appendix C, Noise and Vibration Technical Report

[a] SFR = Single-Family Residence; MFR = Multi-Family Residence

[b] Existing total noise exposure based on representative noise measurement data (see Table 3.11-6).

[c] Project/Alternative total noise exposure is the result of combining future Caltrain noise with existing non-railroad noise and freight train noise, as in Table 3.11-6.

Results in bold exceed the FTA impact criteria.

1

The T4DL-SH Alternative would have similar but lesser noise effects than the T4DL-DH Alternative and greater noise levels at all 49 locations compared to the Proposed Project. However, the T4DL-SH Alternative would not result in any exceedances of the FTA noise criteria and thus, like the Proposed Project would not result in a significant project-level noise impact. Results for noise evaluation of both the T4DL-SH and T4DL-DH Alternative are found in Appendix C.

Vibration impacts of the T4DL Alternative should be similar to the Proposed Project, but the T4DLs would likely have greater vibration than the EMUs. As discussed in Section 3.11, *Noise and Vibration*, the EMUs are not expected to have significantly different vibration characteristic than existing conditions, so the differences between alternatives for operational vibration are not substantial.

Population and Housing

This alternative would not indirectly or directly induce population growth or the demand for new housing units in the project area. Similar to the Proposed Project, operation of this alternative would not require the displacement of existing housing units or businesses. Therefore, the impact on population and housing would be the similar to the Proposed Project and the No Project Alternative.

Public Services and Utilities

With the T4DL Alternative, operations would not have appreciable changes in public services demand, similar to the Proposed Project, and no effect on utility disruption. Thus, the Proposed Project, the No Project Alternative, and the T4DL Alternative would all have similar effects on public services and utilities during operations.

Transportation/Traffic

Regional Traffic

Under the T4DL Alternative, there would be an increase in rail service similar to the Proposed Project and more trains than with the No Project Alternative. Regionally, the T4DL-SH Alternative, would result in a lesser reduction in VMT and associated general traffic congestion compared with the Proposed Project because the T4DL-SH Alternative would have inferior performance relative to the Proposed Project's EMUs and thus would result in less Caltrain ridership. The T4DL-DH Alternative would have the same ridership in 2020, but likely lower ridership in 2040, due to not being able to reach TTC.

The T4DL Alternative would be beneficial compared with the No Project Alternative due to the increased service and reduction of VMT.

Localized Traffic at Certain At-Grade Crossings and Caltrain Stations

In comparison with the Proposed Project, the ridership under this alternative under the single head scenario would be somewhat less.

The T4DL Alternative would result in the same number of gate-down events during peak hours at the at-grade crossings as the Proposed Project. At at-grade crossings that are not near stations, the gate-down time should be similar to the Proposed Project. At at-grade crossings that are near stations, the T4DL Alternative single-head variant would result in greater gate-down time than the Proposed Project due to the slower deceleration and acceleration performance but the double-head trains would have similar performance and thus similar gate-down time. Thus, at at-grade crossing

near stations, the T4DL alternative would have a greater impact on localized traffic than the Proposed Project would have under the single-head scenario but similar impacts under the double-head scenario.

Since the T4DL alternative would result in less ridership than the Proposed Project in the single-head scenario, traffic levels near Caltrain stations may be somewhat less in general. In the double-head scenario, traffic levels near Caltrain stations would be the same in 2020, but somewhat lower in 2040 due to lower ridership due to not reaching TTC.

Relative to the No Project Alternative, the T4DL Alternative would result in better regional traffic and worse localized traffic at some at-grade crossings and near Caltrain stations.

Ridership of Other Transit Systems

The T4DL Alternative, single-head variant would result in less Caltrain ridership than the Proposed Project and similar 2020 ridership with the double-head variant. Similar to the Proposed Project, this alternative would not substantially change the ridership of other transit systems compared with the No Project Alternative

Conflict with other Transit Projects

The T4DL Alternative, like the No Project Alternative, would avoid any potential OCS-related conflicts with the 22-Fillmore Project or DTX. However, the T4DL Alternative is incompatible with the designs for DTX and TTC and, thus, would not allow a downtown extension of Caltrain as planned, which is a major conflict given that the extension is one of the driving rationales for DTX and TTC.

The Proposed Project's impacts related to the OCS for other transit projects are either less than significant or can be managed with mitigation. The Proposed Project is consistent with DTX and TTC designs; therefore, the T4DL Alternative would have more conflict with other transit projects than the Proposed Project would have.

Pedestrian/Bicycle Facilities

As discussed in Section 3.14, *Transportation and Traffic,* the Proposed Project would have a less than significant impact on pedestrian facilities with mitigation. Since ridership would increase with the T4DL Alternative, but less than with the Proposed Project, the T4DL Alternative would have a smaller less than significant impact (with mitigation) on pedestrian facilities.

As discussed in Section 3.14, *Transportation and Traffic* and Section 4.1, *Cumulative Impacts*, the Proposed Project would result in an increased demand for bike facilities, but proposed mitigation would address this increased demand. There would also be an increase in demand for bike facilities with the increased ridership expected with the T4DL Alternative; however, Caltrain could address this demand by similar means as the proposed mitigation for the Proposed Project. Thus, the T4DL Alternative would have a lesser impact than the Proposed Project relative to bicycle facilities.

Because of greater ridership, this alternative would have more impact on existing pedestrian and bicycle facilities than the No Project Alternative would have.

Station Parking and Access

As discussed in Section 3.14, *Transportation and Traffic* and Section 4.1, *Cumulative Impacts*, the Proposed Project would result in an increased demand for parking, but this would not result in

significant secondary impacts on air quality, noise, or traffic or due to the construction of other parking facilities. The T4DL Alternative would result in a lower increase in parking demand in the long run and, therefore, would have less impact than the Proposed Project relative to parking demand.

Because of greater Caltrain ridership, this alternative would have more impact on station parking and access than the No Project Alternative would have.

Emergency Vehicle Access

Relative to emergency vehicle access, the T4DL Alternative would have a similar but smaller positive effect on reducing regional vehicle miles traveled in the long run, a similar but smaller adverse effect at at-grade crossings and at intersections near stations. This alternative would have similar but fewer overall beneficial impacts on emergency response times than the Proposed Project would have.

This alternative would be beneficial relative to the No Project Alternative.

Freight Rail Operations

The T4DL Alternative could share tracks with freight and thus would have no effect on freight operational windows.

The T4DL Alternative would not require an OCS, and, thus, there would be no concerns about potential height restrictions for freight. The Proposed Project would provide adequate height clearance for existing freight service. As discussed in Section 4.1, *Cumulative Impacts*, future freight trains could be slightly constrained to the existing freight train equipment heights. But even with limited freight diversion to other modes (such as trucks), this constraint is not likely to result in significant secondary physical impacts on the environment but is disclosed conservatively to potentially have localized noise or traffic impacts if diversion to trucks does occur. The T4DL Alternative would avoid any such impacts because it would not restrict overhead heights along the Caltrain ROW.

Overall, this alternative would have the same impacts as the No Project Alternative.

5.2.5 Electrification with OCS Installation by "Factory Train"

This alternative consists of the same operational elements as the Proposed Project (electrified service with EMUs) but with a different method for construction of the OCS.

An alternative method of installing the OCS could be through the use of a so-called "Factory Train" (also called an "Electrification Train" and a "High Output Plant System" or the HOPS train), which is a moveable assembly line system, mounted on rails. One of the prime advantages of a Factory Train is the rate of progress in OCS installation. Rates of progress up to 1 mile/night have been reported, and the system can reportedly be used while allowing for adjacent rail lines to be used by existing trains (European Railway Review 2011) although there may be speed restrictions for the use of adjacent lines (Railway Gazette 2013a).

This is a new technology developed by a German company, Windhoff Bahn- und Anlagentechnik GmbH. The first reported use of this system will be on the Great Western Main Line Electrification Project for Network Rail in the United Kingdom (UK), starting in early 2014 The system that has been assembled for the UK project cost £40 million (about $67 million as of early January 2014) and

consists of 23 vehicles with a combined length of 500 meters (about 1,640 feet) (Railway Gazette 2013a). The different elements to the HOPS train to be used for the UK project are as follows (Network Rail UK 2013).

- A piling rig (with two multi-purpose vehicles with Movax vibro piling heads, to vibrate the steel piles into the soil, two pile carrying wagons, and a Fambo hydraulic percussion hammer multi-purpose vehicle for tougher ground)[10].
- An excavation and concrete batching unit with an Hitachi excavator plus a Kniele concrete unit to mix concrete from onboard aggregate, cement, and water tanks.
- A structures unit that erects the masts, portal booms, and twin track cantilevers.
- An ancillary conductor to install the earthing wires, return wires, and small parts such as registration arms and other equipment.
- The contact and catenary unit to string up the remaining wires under tension. Another unit installs other things such as wires under low bridges, and records information such as height and stagger.

Each of the above elements includes two multi-purpose vehicles with full driving cabs, powered by MTU power packs, which can be driven at 60 mph offsite. Onsite driving cabs mean the train can be driven very slowly when installing contact wire.

The HOPS being used for the project in the UK is based at a purpose-built depot and then split up, to head to different parts of the line at its 60 mph top speed. It carries enough supplies and equipment to avoid the need to bring anything to the trackside on trucks. Staff can be picked up at stations en-route (Network Rail 2013). Construction is planned to be six nights per week (Network Rail 2013).

Given that the manufacturer is a German company and no other manufacturers have such a system at present, use of this method would require transporting such a system via ship to the United States and then transporting it to the Caltrain ROW via rail.

No feasibility or cost analysis has been completed ~~for the Proposed Project using~~ for this construction method. A Factory Train built in Germany and used in the UK may be not be feasible here because of the potentially lengthy FRA certification process. An additional concern would be the 0.31 mile train length, which would block some at-grade crossings when in operation.

As a rough comparison of costs, Network Rail in the U.K. is electrifying 2,000 track miles, including the Great Western Line using a factory train approach for approximately $3.3 billion ($2014), which corresponds to a cost of $1.6 million per track mile. As described in Chapter 2, the cost estimate for electrifying the Caltrain Corridor is $950 million to $958 million, which corresponds to approximately $7 million per track mile. The U.K. electrification program noted above, while including some urban areas, also includes extensive rural areas where costs will be lower due to ease of construction in contrast to the Caltrain Corridor which is entirely within the an urban context, which makes for more difficult construction. There are also substantial differences between California and the United Kingdom in terms of labor markets, cost of living, costs of materials, as well as experience construction electrification projects. However, despite the substantial contextual differences between the U.K. electrification programme and the PCEP, a factory train still has the potential to reduce construction costs substantially due to the rate of progress and efficiency of construction.

[10] At present, the ~~35%~~ preliminary design for the Proposed Project does not include any piles.

For the purpose of this analysis, a Factory Train is considered feasible.

The following assumptions are made only for the purposes of the alternative analysis.

- The Factory Train can be manufactured (even if in Europe) and transported to the Caltrain ROW via ship and rail.
- Construction using this method would be comparable in cost or less costly than conventional construction.
- The Factory Train would be used to install approximately 80 percent of the OCS installation, and conventional construction would be used in areas of complexity or construction, including stations, tunnels, complex junctions, and sidings.
- Construction is assumed to be at night[11] with allowed use of adjacent tracks by passenger and freight rail, though possibly with speed restrictions.
- Because this is a new system that has not yet completed its first project, a 50 percent contingency is used to derive an estimated average rate of progress of 0.5 mile/night, and construction is assumed to be 5 nights/week. Assuming that 80 percent of the 130 to 140 miles of OCS system would be installed by a Factory Train, this portion of the OCS system could be completed in approximately 10 to 11 months. The remaining 20 percent of the OCS system is assumed to be constructed using conventional methods and would take approximately 6 to 7 months for a total of 16 to 18 months (compared with the Proposed Project's schedule for overall OCS installation of 33 months).[12] <u>If the conventional work is done in parallel to the use of the Factory Train, this could cut an additional 6 to 7 months from the construction schedule.</u>
- One operational base would be needed for the system. The location of this base is unknown, but possible locations could include the former railyard in Brisbane south of the Caltrain Bayshore Station,[13] CEMOF, the South San Francisco yard, or other locations not yet identified. The base could be located off the Caltrain ROW at a suitable yard with sufficient size and rail access, provided it is sufficiently close to the Caltrain ROW to allow for rapid deployment each night. The operational base would require several buildings, vehicle access, lighting, potential reconfiguration of track access, parking and receiving space for deliveries, and storage areas for construction materials and fuels.

This alternative is only a construction methodology alternative to conventional construction of the OCS. Thus, analysis is limited to differences between the Proposed Project and this alternative relative to OCS construction. As noted above, about 80 percent of the OCS is presumed to be installed using a Factory Train with the remaining 20 percent assumed to be installed using conventional construction. Thus, the discussion below is only relevant to the 80 percent installed by a Factory Train with this alternative; impacts on the other 20 percent would be the same as for the Proposed Project.

[11] There is nothing to prevent use of the Factory Train during the day, but this would substantially disrupt passenger rail service to shut down one line and thus it was assumed that construction would be at night. The Proposed Project assumes that a substantial amount of work would likely also need to be at night to avoid disruption of passenger rail service.

[12] By way of comparison, the Great Western Main Line project plans to install approximately 16,000 OCS poles over 4 years, which works out to an average of a 330 poles/month.

[13] Presuming this site is available during construction. As described in Chapter 4, *Other CEQA-Required Analysis*, this site is proposed for mixed use development by the Brisbane Baylands project.

This alternative would have greater construction impacts than the No Project Alternative (which does not include construction) and the Dual-Mode MU Alternative and the DMU Alternative (which have less construction).

Aesthetics

This alternative would have the same construction impacts due to tree removal/trimming as the Proposed Project. The temporary construction aesthetic impacts could be more or less than the Proposed Project depending on individual perceptions regarding the tradeoff of duration reduction with a likely increase in the intensity of nighttime construction. However, construction staging may be more consolidated with this alternative, which could reduce temporary impacts on any staging areas with adjacent sensitive receptors that are avoided. OCS construction aesthetic disruption would be shorter overall and likely shorter at individual locations, but the activity would always be at night and would be more intense with the Factory Train. However, use of the Factory Train would reduce impacts associated with material and personnel trucks because they can both be brought to each construction site by the Factory Train itself (there would still be some local vehicle access for support activities). For those people perceiving that a greater level of nighttime intensity would outweigh the benefits of a shorter construction duration, this alternative would have greater impacts. For people perceiving that the benefits of a shorter construction duration would outweigh a greater level of nighttime construction intensity, this alternative would result in less impact than the Proposed Project.

Air Quality

The only prior environmental statement for use of a Factory Train (for the Great Western Main Line Electrification Project; Atkins 2012) did not provide any quantification of construction criteria pollutant emissions. Because of the lack of data, a quantitative comparison of this alternative's construction emissions with the Proposed Project's emissions was not completed; however, a qualitative assessment was completed.

The Factory Train would result in construction criteria pollutant emissions for both the onboard equipment as well as the train's diesel engine itself. The emissions for the various construction activities themselves (installing foundations, erecting poles, stringing wire) are likely similar to the emissions for conventional construction. The *Great Western Main Line Environmental Statement* (Atkins 2012) noted that at any one receptor, the duration of impact would be between a few hours and one night as the OCS is installed within proximity of any one receptor, and asserted that emissions from the Factory Train were unlikely or had a low potential to be significant in relation to annual or hourly air quality ambient concentrations.

Overall, lacking a strict quantitative basis by which to compare this alternative to the Proposed Project, it is considered unlikely that overall construction criteria pollutant emissions would be substantially greater with this alternative or would cause any exceedance of hourly or annual air quality ambient standards. Given that the Factory Train would install the OCS faster than conventional construction, it is possible that daily emissions might be higher due to the greater intensity of activity, but that has to be balanced with the offsetting greater efficiency of this method, which should result in less emissions. The consolidation of transportation of equipment, materials, and crews made possible with a Factory Train compared with the separate transport of all three with conventional construction means there could be a possible overall net reduction in construction emissions measured over the entire construction duration.

Concerning TAC emissions, the Factory Train would also have DPM emissions from construction equipment on the train and the train's diesel engines. Health risks from DPM emissions are concerned with the overall mass of emissions in all of construction, which are considered to be no greater than and possibly lower with the Factory Train than the Proposed Project given the greater efficiency of this construction method.

Biological Resources

This alternative would result in the same tree removal and trimming and similar activity along the Caltrain ROW as the Proposed Project. However, construction staging may be more consolidated with this alternative, which could reduce temporary impacts on any staging areas that contain biological resources (most staging areas for the Proposed Project would be in locations with no or limited biological resources).

Cultural Resources

This alternative would have similar overall impacts as the Proposed Project relative to cultural resources because the amount of excavation and alteration to structures would be the same. Construction at historic stations and tunnels would not be different with this alternative, particularly since construction at some stations and all tunnels would likely be with conventional construction. However, construction staging may be more consolidated with this alternative, which could reduce temporary potential for disturbance of cultural resources at staging areas (if and where present).

Geology, Soils, and Seismicity

This alternative would have similar impacts as the Proposed Project relative to geology, soils, and paleontological resources because the amount of excavation would be the same. However, construction staging may be more consolidated with this alternative, which could reduce temporary erosion impacts at staging areas.

Greenhouse Gas Emissions and Climate Change

The only prior environmental statement for use of a Factory Train (for the Great Western Main Line Electrification Project; Atkins 2012) did not provide any quantification of construction GHG emissions. Because of the lack of data, a quantitative comparison of this alternative's construction emissions with the Proposed Project's emissions was not completed; however, a qualitative assessment was completed.

As discussed above in the *Air Quality* section, a Factory Train would be more efficient overall than conventional construction by consolidating staging and the transportation of equipment, materials, and personnel to and from the construction site. Therefore, it is doubtful that GHG emissions for this alternative would be greater than for the Proposed Project, and GHG emissions would possibly be lower.

Hazards and Hazardous Material

This alternative would have similar impacts as the Proposed Project relative to excavation of potentially contaminated areas. However, construction staging may be more consolidated with this alternative, which may reduce the potential for accidental release of petroleum or hazardous materials.

Hydrology and Water Quality

This alternative would have similar impacts as the Proposed Project. However, construction staging may be more consolidated with this alternative, which may reduce the potential for erosion/sedimentation as well as accidental release of petroleum or hazardous materials.

Land Use and Recreation

Similar to the discussion of aesthetics above, the temporary construction and temporary disruption of land use could be more or less than the Proposed Project depending on individual perceptions regarding the tradeoff of duration reduction vs. an increase in nighttime construction intensity. However, construction staging may be more consolidated with this alternative, which could reduce temporary land use impacts at staging areas overall. OCS construction land use disruption would be shorter overall and likely shorter at individual locations, but the activity would always be at night and would be more intense for sensitive land uses (i.e., residential) with the Factory Train. For those people perceiving that a greater level of nighttime intensity would outweigh the benefits of a shorter construction duration, this alternative would have greater temporary land use disruption impacts. For people perceiving that the benefits of a shorter construction duration outweigh a greater level of nighttime construction intensity, this alternative would result in less temporary land use disruption than the Proposed Project.

Because recreational use occurs during daytime (for the most part), this alternative would result in less construction disruption than the Proposed Project because it would limit OCS installation to nighttime. Removal of trees and trimming would need to occur during the day (prior to arrival of the Factory Train), and thus recreational disruption due to tree removal/trimming would be the same as for the Proposed Project.

Noise and Vibration

The temporary construction noise impacts could be more or less than the Proposed Project depending on individual perceptions regarding the tradeoff of noise impact duration reduction vs. increased nighttime noise impacts. OCS construction noise disruption would be shorter overall and likely shorter at individual locations, but the activity would always be at night and may be more intense with the Factory Train. Review of the Environmental Impact Statement prepared for the first use of a Factory Train (Atkins 2012) indicated that, in general, the noise of the individual pieces of equipment on the Factory Train would be similar to the noise levels estimated in Section 3.11, *Noise and Vibration*, for conventional construction of the OCS. However, with the Factory Train, the diesel engine on the train itself is likely to be in continuous operation and is one of the noisier elements associated with OCS installation next to the hydraulic hammer rig (Atkins 2012).

Use of the Factory Train would reduce noise impacts associated with material and personnel trucks because they can both be brought to each construction site by the Factory Train itself (there would still be some local vehicle access for support activities). For those people perceiving that a greater level of nighttime noise would outweigh the benefits of a shorter construction duration, this alternative would have greater impacts. For people perceiving that the benefits of a shorter construction duration would outweigh a greater level of nighttime noise, this alternative would result in less impact than the Proposed Project.

Population and Housing

This alternative would have a similar, less-than-significant temporary impact as the Proposed Project, although impacts might be a little less due to a shorter duration of construction.

Public Services and Utilities

This alternative would have the same impact as the Proposed Project relative to utility disruption because utilities would have to be relocated and excavation would have to occur in the same manner as the Proposed Project. This alternative would have a similar, less-than-significant temporary impact on public services as the Proposed Project, although impacts might be a little less due to a shorter duration of construction.

Transportation/Traffic

This alternative would have similar but possibly greater temporary traffic impacts overall during construction. There would be a shorter duration of construction, consolidation of staging areas, and delivery of materials and crew using the Factory Train itself, which would help to reduce construction traffic overall.

The Factory Train would result in more nighttime traffic delays at the at-grade crossings. The Factory Train can be quite lengthy, and, thus, during transit along the Caltrain ROW would result in more lengthy gate-down times at at-grade crossings than the Caltrain passenger trains. Also, the Factory Train could block at-grade crossings during OCS installation near at-grade crossings. Because construction would be at night outside of peak hours, the increased traffic delays would be adverse, but less than significant. The Factory Train is often broken up into its element parts when working on the OCS installation itself, and thus temporary closure of at-grade crossings can be managed to limit the time to when the different elements of the Factory Train need to work at the at-grade crossing itself.

Given that this alternative is presumed to be constructed at night outside of peak hours, this alternative is considered likely to result in fewer temporary traffic impacts than the Proposed Project relative to OCS installation. Because the project's effects on traffic would be less, it would also have less impact on emergency vehicle response time

5.3 Environmentally Superior Alternative

The State CEQA Guidelines require that an environmentally superior alternative be identified. The environmentally superior alternative is the alternative that would avoid or substantially lessen, to the greatest extent, the environmental impacts associated with the project while feasibly obtaining most of the major project objectives. If the alternative with the least environmental impact is determined to be the No Project Alternative, the EIR must also identify an environmentally superior alternative among the other alternatives.

The identification of the environmentally superior alternative results from a comparison of the impacts associated with each alternative to the Proposed Project, as shown in Table 5-11 ~~5-6~~. As shown in that table, there are distinct differences between the construction impacts and operational impacts of the alternatives.

For construction, the No Project Alternative and the Tier 4 Diesel Locomotive Alternative would both be the environmentally superior alternative because ~~it~~ neither would have ~~no electrification infrastructure (OCS or TPF)~~ construction. ~~Excluding the No Project Alternative,~~ The Dual-Mode MU Alternative ~~would be the environmentally superior construction alternative because it~~ would result in a lower level of construction than the DMU Alternative, the Proposed Project and the Electrification with OCS Installation by Factory Train Alternative. Given what is known about the Factory Train construction at this time,[14] it is considered environmentally superior to the Proposed Project for construction.

For operations, the No Project Alternative would be environmentally inferior to the DMU Alternative, the Dual-Mode MU Alternative, the Tier 4 Diesel Locomotive Alternative and the Proposed Project because it would result in substantially lower ridership and, thus, higher criteria pollutant and GHG emissions, ~~higher noise levels at a majority of locations~~, and worse regional traffic conditions. However, the No Project Alternative would have lower noise levels than the DMU Alternative, the Dual-Mode MU Alternative and the Tier 4 Diesel Locomotive Alternative. The Dual-Mode MU Alternative would have higher 2020 operational impacts than the DMU Alternative for 2020 (due to a heavier train set and likely more fuel consumption), but due to likely higher ridership in the long run with DTX/TTC, the Dual Mode MU Alternative is likely to result in long-term better air quality, lower GHG emissions and better regional traffic conditions than the DMU Alternative and the Tier 4 Diesel Locomotive Alternative. Thus, for operations, of the alternatives to the Proposed Project, the Dual-Mode MU Alternative would be the environmentally superior alternative.

However, compared with the Proposed Project, the non-electrification alternatives ~~Dual-Mode MU Alternative and the DMU Alternative~~ would result in higher criteria pollutant and GHG emissions, higher noise levels, and likely worse regional traffic in the long run, but would avoid the long-term impacts of the OCS infrastructure and tree removal.[15] The tradeoff between aesthetics impacts versus air quality, GHG emissions, noise, and traffic impacts is not easily evaluated given the dissimilar nature of these different impacts. Nevertheless, one way to evaluate these impacts is to identify the people affected by these different impacts.

- Aesthetics: As described in Section 3.1, *Aesthetics*, the permanent effects of the OCS infrastructure and tree removal would primarily affect the visual character of the area immediately around the Caltrain ROW instead of significantly affecting scenic vistas. Thus, the sensitive receptors of this impact are the residents of adjacent homes, users of adjacent parks, and the less-sensitive workers at adjacent businesses (industrial and roadway receptors are not considered sensitive to aesthetics). Consequently, where residential areas and parks are located adjacent to the Caltrain ROW, the immediately adjacent users would be significantly less affected relative to aesthetics by the non-electrification alternatives ~~Dual-Mode MU Alternative and the DMU Alternative~~ compared to the Proposed Project.

[14] As noted above, this is a new technology, and the first OCS installation using it starts in early 2014, so there is no in-practice data by which to judge the impacts of that project, only the one single Environmental Statement completed for the Great Western Main Line Electrification Project. Despite that project lacking certain data, such as quantification of construction air quality or GHG emissions, the evidence in the Environmental Statement appears to support a conclusion that taking into account all construction subjects, a Factory Train alternative would be environmentally superior.

[15] As described in Section 3.3, *Biological Resources*, the Proposed Project's biological impacts relative to tree removal can be mitigated to less-than-significant levels, but as noted in Section 3.1, *Aesthetics*, the visual aesthetic impacts of tree removal may not always be mitigable to a less-than-significant level; thus, the comparison herein focuses on the visual aesthetic impacts of tree removal.

Table 5-11 ~~5-6~~. Comparison of Project Alternatives with the Proposed Project

Environmental Topic Area	Level of Proposed Project Impact	No Project Alternative (Relative to the Proposed Project)	DMU Alternative (Relative to the Proposed Project and No Project Alternative)	Dual-Mode Multiple Unit Alternative (Relative to the Proposed Project , DMU Alternative and the No Project Alternative)	Tier 4 Diesel Locomotive Alternative (DH Variant) (Relative to the Proposed Project and other operational alternatives)	Electrification with OCS Installation by Factory Train Alternative (Relative to Proposed Project, OCS construction only)
Aesthetics	Construction: Less than significant with mitigation	No impact (less)	Less than Proposed Project Greater than No Project	Less than Proposed Project and DMU Greater than No Project	Less than Proposed Project, DMU and Dual-Mode MU Alternative Same as No Project	Greater or less than Proposed Project depending on perception of tradeoff of shorter duration for higher intensity
	Operations: **Significant and unavoidable (tree removal)** Less than significant with mitigation (all other impacts)	No impact (less)	Less than Proposed Project (overall but visual changes at Caltrain stations greater than Proposed Project) Greater than No Project	Less than Proposed Project and DMU Greater than No Project	Less than Proposed Project, DMU and Dual-Mode MU Alternative Same as No Project	Same as Proposed Project
Air Quality	Construction: Less than significant with mitigation	No impact (less)	Less than Proposed Project Greater than No Project	Less than Proposed Project and DMU Greater than No Project	Less than Proposed Project, DMU and Dual-Mode MU Alternative Same as No Project	Not likely to be greater and possibly less than Proposed Project overall due to increased efficiency.
	Operations: Beneficial (criteria pollutants and toxic air contaminants)	No impact (greater)	Greater than Proposed Project Less than No Project	Greater than Proposed Project Greater than DMU for 2020 but less for 2040 Less than No Project	Greater than Proposed Project, DMU, and Dual-Mode MU Alternative Less than No Project	Same as Proposed Project
Biological Resources	Construction: Less than significant with mitigation	No impact (less)	Less than Proposed Project Greater than No Project	Less than Proposed Project and DMU Greater than No Project	Less than Proposed Project, DMU and Dual-Mode MU Alternative Same as No Project	Similar to Proposed Project (possibly less due to more central staging)
	Operations: Beneficial due to reduction of diesel and nitrogen emissions	Not beneficial	Less Beneficial than Proposed Project More Beneficial than No Project	Less Beneficial than Proposed Project and DMU for 2020 but more beneficial for 2040 More Beneficial than No Project	Less Beneficial than Proposed Project, DMU and Dual-Mode MU Alternative More Beneficial than No Project	Same as Proposed Project
Cultural Resources	Construction: Less than significant with mitigation	No impact (less)	Less than Proposed Project except at historic Caltrain stations More than No Project	Less than Proposed Project and DMU Greater than No Project	Less than Proposed Project, DMU and Dual-Mode MU Alternative Same as No Project	Similar to Proposed Project (possibly less due to more central staging)
	Operations: No impact	No impact (same)	No Impact (same as Proposed Project and No Project)	No Impact (same as all others)	No Impact (same as Proposed Project, other alts. and No Project)	Same as Proposed Project
EMF/EMI	Operation Only: Less than significant (EMF) Less than significant with mitigation (EMI)	No impact (less)	No Impact (less than Proposed Project; same as No Project)	Less impact than Proposed Project Greater impact than DMU and No Project	No Impact (less than Proposed Project; same as No Project and other alts.)	Same as Proposed Project
Geology and Soils	Construction: Less than significant with mitigation	No impact (less)	Greater than Proposed Project (due to more excavation) Greater than No Project	Less than Proposed Project and DMU Greater than No Project	Less than Proposed Project, DMU and Dual-Mode MU Alternative Same as No Project	Similar to Proposed Project (possibly less due to more central staging)
	Operations: No impact	No impact (less)	No Impact (same as Proposed Project and No Project)	No Impact (same as others)	No Impact (same as Proposed Project, other alts. and No Project)	Same as Proposed Project
Greenhouse Gas Emissions and Climate Change	Construction/Operations: Beneficial (GHG emissions)	Not beneficial	Less beneficial than Proposed Project More beneficial than No Project	Less beneficial than Proposed Project Less beneficial than DMU for 2020 but more for 2040 More beneficial than No Project	Less beneficial than Proposed Project, DMU and Dual-Mode MU Alternative More beneficial than No Project	For construction: Not likely to be greater and possibly less than Proposed Project overall due to increased efficiency. For operation: Same as Proposed Project.
	Less than significant (climate change effects other than sea level rise)	Similar	Similar to other alternatives	Similar to other alternatives	Similar to other alternatives	Same as Proposed Project

Environmental Topic Area	Level of Proposed Project Impact	No Project Alternative (Relative to the Proposed Project)	DMU Alternative (Relative to the Proposed Project and No Project Alternative)	Dual-Mode Multiple Unit Alternative (Relative to the Proposed Project , DMU Alternative and the No Project Alternative)	Tier 4 Diesel Locomotive Alternative (DH Variant) (Relative to the Proposed Project and other operational alternatives)	Electrification with OCS Installation by Factory Train Alternative (Relative to Proposed Project, OCS construction only)
Hazards and Hazardous Materials	Construction: Less than significant with mitigation	No impact (less)	Less than Proposed Project Similar to No Project	Less than Proposed Project and DMU Greater than No Project	Less than Proposed Project, DMU and Dual-Mode MU Alternative Same as No Project	Similar to Proposed Project (possibly less due to shorter duration)
	Operations: Less than significant with mitigation	No impact (greater)	Greater than Proposed Project Similar to No Project	Greater than Proposed Project Greater than DMU for 2020 but less for 2040 Similar to No Project	Greater than Proposed Project, DMU, and Dual-Mode Alternative, and No Project (due to more diesel use)	Same as Proposed Project
Hydrology and Water Quality	Construction: Less than significant with mitigation	No impact (less)	Less than Proposed Project Greater than No Project	Less than Proposed Project and DMU Greater than No Project	Less than Proposed Project, DMU and Dual-Mode MU Alternative Same as No Project	Similar to Proposed Project (possibly less due to more central staging)
	Operations: Less than significant with mitigation	No impact (greater: water quality; less: flooding)	Greater than Proposed Project and No Project (water quality and possibly flooding)	Less than Proposed Project for flooding but greater for water quality (due to more diesel use) Similar to DMU Alternative and No Project (water quality and possibly flooding)	Greater than Proposed Project, No Project, DMU and dual-Mode Alternative (water quality due to diesel use)	Same as Proposed Project
	Flooding relative to sea level rise (potentially significant and unavoidable)	Similar	Similar to other alternatives	Similar to other alternatives	Similar to other alternatives	Same as Proposed Project
Land Use and Recreation	Construction: Less than significant with mitigation	No impact (less)	Less than Proposed Project Same as No Project	Less than Proposed Project Same as DMU Alternative and No Project	Less than Proposed Project, DMU and Dual-Mode MU Alternative Same as No Project	Tradeoff of shorter duration for higher intensity
	Operations: Less than significant with mitigation	No Impact (less)	No impact (Less than Proposed Project; Same as No Project)	No impact (Less than Proposed Project; Same as DMU Alternative and No Project)	No impact (Less than Proposed Project and other alternatives) Same as No Project	Same as Proposed Project
Noise and Vibration	**Construction: Significant and unavoidable with mitigation**	No impact (less)	Less than Proposed Project (overall, but higher intensity at Caltrain stations) Greater than No Project	Less than Proposed Project and DMU Greater than No Project	Less than Proposed Project, DMU and Dual-Mode MU Alternative Same as No Project	Greater or less than Proposed Project depending on perception of tradeoff of shorter duration for potential higher nighttime intensity.
	Operational noise: • Beneficial at many study locations (33) • No change at some locations (8) • Less than significant at some locations (8) Operational vibration: Less than significant	No impact (greater)	Similar to but slightly greater than Proposed Project (DMUs noisier than EMUs) Greater than No Project Alternative overall (DMUs quieter than diesel locomotives but more train noise due to service increase)	Greater than Proposed Project (Dual-Mode MUs noisier than EMUs) Similar to but possibly slightly greater than DMU Similar to No Project Alternative overall (Dual-Mode MUs quieter than diesel locomotives but more train noise due to service increase; traction power facility noise can be mitigated as under Proposed Project)	Greater than Proposed Project, No Project, DMU, and Dual-Mode Alternative (more diesel locomotives are louder than other technologies and louder than less number of trains with No Project)	Same as Proposed Project
Population and Housing	Less than significant	No impact (same)	Same as Proposed Project Greater than No Project	Same as Proposed Project and DMU Greater than No Project	Same as Proposed Project, DMU and Dual-Mode MU Greater than No Project	Same as Proposed Project
Public Services and Utilities	Construction: Less than significant with mitigation	No impact (less)	Less than the Proposed Project Greater than No Project	Less than the Proposed Project and DMU Greater than No Project	Less than Proposed Project, DMU and Dual-Mode MU Alternative Same as No Project	Same as Proposed Project
	Operations: Less than significant	No impact (same)	Same as Proposed Project Greater than No Project	Same as Proposed Project and DMU Greater than No Project	Same as Proposed Project, DMU, and Dual-Mode MU Alternative Greater than No Project	Same as Proposed Project

Environmental Topic Area	Level of Proposed Project Impact	No Project Alternative (Relative to the Proposed Project)	DMU Alternative (Relative to the Proposed Project and No Project Alternative)	Dual-Mode Multiple Unit Alternative (Relative to the Proposed Project , DMU Alternative and the No Project Alternative)	Tier 4 Diesel Locomotive Alternative (DH Variant) (Relative to the Proposed Project and other operational alternatives)	Electrification with OCS Installation by Factory Train Alternative (Relative to Proposed Project, OCS construction only)
Transportation and Traffic	Construction: Less than significant with mitigation	No impact (less)	Less than Proposed Project Greater than No Project	Less than Proposed Project and DMU Greater than No Project	Less than Proposed Project, DMU and Dual-Mode MU Alternative Same as No Project	Tradeoffs of less traffic due to shorter duration, consolidated staging areas and delivery of materials and crew by train with increased nighttime delays at the at-grade crossings. Given construction would be outside of peak hours, overall traffic impacts likely less than Proposed Project.
	Regional traffic and congestion: Beneficial	No impact (greater)	Less beneficial than Proposed Project More beneficial than No Project	Less beneficial than Proposed Project Less beneficial than DMU for 2020 but more beneficial for 2040. More beneficial than No Project	As beneficial as Proposed Project in 2020, but less beneficial in 2040 (no TTC). Similar to DMU and Dual Mode MU in 2020. Similar to DMU in 2040. Less beneficial than Dual Mode MU in 2040 More beneficial than No Project	Similar to Proposed Project (but night-time traffic effects higher during OCS installation, offset by shorter duration).
	Localized traffic: Nine intersections, significant and unavoidable with mitigation	No Impact (less)	Similar to Proposed Project Greater than No Project	Similar to Proposed Project and DMU Greater than No Project	Same as Proposed Project in 2020, but less adverse in 2040. Similar to DMU and Dual Mode MU in 2020. Similar to DMU in 2040. Less adverse than Dual Mode MU in 2040 Greater than No Project	Same as Proposed Project
	Transit: Less than significant	Greater impact due to conflict with plans for DTX and TTC	Greater than Proposed Project due to conflict with DTX/TTC Same as No Project	Less than Proposed Project Less than DMU and No Project	Greater than Proposed Project and Dual-Mode MU due to conflict with DTX/TTC Same as No Project and DMU.	Same as Proposed Project
	Bike: Less than significant with mitigation Pedestrian: Less than significant with mitigation at one location	No impact (less)	Less than Proposed Project Greater than No Project	Less than Proposed Project Less than DMU Greater than No Project	Same as Proposed Project in 2020, but less in 2040. Similar to DMU and Dual Mode MU in 2020. Similar to DMU in 2040. Less than Dual Mode MU in 2040 Greater than No Project	Same as Proposed Project
	Station parking and access: Less than significant	No impact (less)	Similar but less than Proposed Project Greater than No Project	Station Parking and Access Similar but less than Proposed Project Similar to DMU Greater than No Project	Same as Proposed Project in 2020, but less in 2040. Similar to DMU and Dual Mode MU in 2020. Similar to DMU in 2040. Less than Dual Mode MU in 2040 Greater than No Project	Same as Proposed Project
	Emergency vehicle access: Less than significant	Greater regional impact due to higher regional VMT	Similar but less than Proposed Project Less than No Project	Similar to Proposed Project and DMU Less than No Project	Same as Proposed Project in 2020, but greater in 2040. Similar to DMU and Dual Mode MU in 2020. Similar to DMU in 2040. Greater than Dual Mode MU in 2040 Less than No Project	Same as Proposed Project
	Freight rail operations: Less than significant Cumulative rail vertical clearance: Potentially significant	No impact (less)	Less than Proposed Project (due to lack of OCS) Same as No Project ~~for FRA-compliant DMUs but greater if non-FRA-compliant DMUs)~~	Less than Proposed Project (due to no OCS except north of area used by freight) Same as DMU and No Project ~~Greater than No Project (due to temporal separation)~~	Less than Proposed Project (due to no OCS) Same as DMU, Dual-Mode MU and No Project	Same as Proposed Project

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- Air Quality: As described in Section 3.2, *Air Quality*, the permanent effects of emissions have two different sets of receptors. Criteria pollutant emissions affect the ambient air quality of the San Francisco Bay Area Basin, which includes the millions of people who reside in the Bay Area. These people would be more affected by the non-electrification alternatives ~~Dual-Mode MU Alternative and the DMU Alternative~~ than by the Proposed Project. TAC emissions affect people in the immediate vicinity of the Caltrain ROW; these are the same people affected by aesthetic impacts of the Proposed Project as described above, and they would be more affected by the non-electrification alternatives ~~Dual-Mode Alternative and the DMU Alternative~~ than by the Proposed Project.
- GHG Emissions: As described in Section 3.7, *Greenhouse Gas Emissions and Climate Change*, GHG emissions contribute to cumulative GHG emissions that affect the global climate, which can result in long-term effects on the Bay Area, California, and the planet as a whole. The non-electrification alternatives ~~Dual-Mode Alternative and the DMU Alternative~~ would have a greater effect on GHG emissions and associated climate change than the Proposed Project.
- Noise: As described in Section 3.11, *Noise and Vibration,* the sensitive receptors of this impact are primarily the residents of adjacent homes, users of adjacent parks, and the less-sensitive workers at adjacent businesses (industrial and roadway receptors are not considered sensitive to noise impacts) along the ROW, in addition to the hotel receptors near one of the traction power substation locations (TPS1, Option 3). These receptors would be more affected by the non-electrification alternatives ~~Dual-Mode Alternative and the DMU Alternative~~ than by the Proposed Project.
- Regional Traffic: As described above, in the long run, the non-electrification alternatives ~~Dual-Mode Alternative and the DMU Alternative~~ would result in somewhat lower ridership than the Proposed Project resulting in higher regional traffic, which would be experienced by drivers on San Francisco peninsula roadways.
- Localized Traffic: As described above, in the long run, the non-electrification alternatives ~~Dual-Mode Alternative and the DMU Alternative~~ would result in somewhat lower ridership than the Proposed Project resulting in somewhat lower localized traffic impacts around Caltrain stations, but these alternatives would result in similar, if not worse traffic near at-grade crossings and thus this not a key differentiator between the alternatives.

The following summarizes the key differentiators between the non-electrification alternatives ~~Dual-Mode Alternative, the DMU Alternative~~ and the Proposed Project.

- Residents, park users, and other sensitive receptors along the Caltrain ROW would have less aesthetic impacts, slightly higher TAC emission health risks, and higher noise impacts with the non-electrification alternatives ~~Dual-Mode Alternative and the DMU Alternative~~.
- Bay Area residents would be more affected relative to air quality and regional traffic by the non-electrification alternatives ~~Dual-Mode Alternative and the DMU Alternative~~ than by the Proposed Project.
- Contributions to GHG emissions, which cumulatively affect the entire planet, would be higher with the non-electrification alternatives ~~Dual-Mode Alternative and the DMU Alternative~~ than with the Proposed Project

While respecting the negative aesthetic impacts that would be experienced by individual receptors, on balance, the Proposed Project is considered environmentally superior to the non-electrification alternatives ~~Dual-Mode Alternative and the DMU Alternative~~ for operations because the air quality,

TAC emission, GHG emissions, noise levels, and regional traffic all affect the physical health or safety of receptors along the Caltrain ROW, in the San Francisco Bay Area, and on the planet as a whole. Comparison of different impact subjects requires one to make value judgments; on balance, the JPB places a greater value on overall public health and safety in making this judgment.

When considering construction and operations together, a similar reasoning is applied. Given the long-term benefits to public health and safety and the temporary nature of construction, the Proposed Project is considered environmentally superior to the No Project Alternative, the Dual-Mode Alternative and the DMU Alternative and the Tier 4 Diesel Locomotive Alternative. Inclusion of the Factory Train Alternative as part of the Proposed Project would be environmentally superior to the Proposed Project only using conventional OCS construction methods. Excluding the Factory Train Alternative, which is only a partial alternative, the Dual-Mode MU Alternative would be the environmentally superior alternative among the full alternatives because it would result in better long-term benefits to public health and safety by having lower criteria pollutant emissions, lower GHG emissions, and lower regional traffic than the DMU Alternative and the No Project Alternative.

5.4 Alternatives Screening Process

The JPB conducted a comprehensive alternative identification and screening process to identify which alternatives to analyze in this EIR. During the scoping process, the JPB solicited input from the public, agencies, and stakeholders about potential alternatives for consideration. The JPB also reviewed the impacts of the Proposed Project and identified several additional potential alternatives for consideration as well. One additional alternative was added in response to comment on the Draft EIR. All of the identified alternatives (52 ~~51~~ in total other than the No Project Alternative) were then further evaluated using a three-level screening analysis described below.

5.4.1 Alternatives Considered

As noted above, alternatives were identified by input from the public, agencies, and stakeholders during scoping, and were also developed by the JPB. The Scoping Summary is provided in Appendix A of this Draft EIR. The following alternatives were identified and classified into several categories, as described below.

5.4.1.1 No Project Alternative

CEQA requires analysis of a No Project Alternative.

5.4.1.2 Technology Alternatives

Technology alternatives considered included the following.

- Use of electric locomotives instead of EMUs.
- Diesel multiple units (DMUs).
- Dual-mode multiple units (Dual-Mode MUs) or locomotives: These trains can operate in both diesel and electric modes. Two variants to this alternative were considered:

  (1) Light-weight alternative compliant Dual-Mode MUs operating in diesel mode from San Jose to San Francisco and electric mode in the DTX ~~tunnel~~ to TTC.

(2) Heavy-weight FRA-compliant dual-mode locomotives operating in diesel mode from Gilroy to San Jose and electrified mode from San Jose to San Francisco.

- Caltrain third-rail alternative.
- Extension of BART from Millbrae to Santa Clara using the Caltrain ROW.
- 100 percent electrified service between San Francisco and San Jose by 2020 ~~2019~~.
- Use of Tier 4 Diesel Locomotives instead of EMUs

5.4.1.3 Electrified Train Design Alternatives

Train design alternatives considered included the following.

- 125 mph trains.
- Single-level trains with less than 30-second dwell times.
- Wifi service on trains.
- Trains with less than 60-second coupling and decoupling (to allow for splitting of trains).

5.4.1.4 Alignment Alternatives

Several alignment alternatives to the Caltrain ROW were considered, as described below.

Horizontal Alignment Alternatives

One horizontal alignment alternative was mentioned in scoping.

- San Francisco Alternative Alignment, which includes undergrounding from around 22nd street to 3rd street and King under Mission Bay (approximately 1.3 miles), a new underground station at 3rd and King, and a new alignment to TTC other than proposed in the DTX.

Vertical Alignment Alternatives

The following vertical alignment alternatives were considered.

- San Francisco Undergrounding (from 22nd, Mariposa, or 16th northward to 4th and King, including new underground station at 4th and King and new offsite storage yard).
- Buried trench (buried the entire way or part of the way).
- Fully grade-separated.
- Elevated alignment in Menlo Park from San Francisquito Creek past Encinal.

Electrification Location Alternatives

Four electrification location alternatives were considered.

- Electric service only in San Francisco (no diesel operations north of Bayshore).
- No electrification of maintenance facilities.

- Electrification of a minimum number of Centralized Equipment Maintenance and Operations Facility (CEMOF) tracks. Use Tracks Nos. 7 and 8 for electrified traffic (instead of MT-2/MT-3) while taking diesel around MT-2/MT-03 loop.
- Electrification of a minimum number of San Jose Diridon Station platforms.

5.4.1.5 Electrified Service Alternatives

Five electrified train service alternatives were considered.

- Five trains pphpd with six-car train consists.
- Five trains pphpd with eight-car train consists.
- EIght trains pphpd with six-car train consists.
- 26 trains/day between San Jose and Gilroy.
- Gilroy/Blossom Hill turnaround instead of at Tamien Station. Alternative was suggested to avoid congestion due to ACE, Capitol Corridor, other use of siding south of Tamien.

5.4.1.6 Platform Alternatives

The platform alternatives considered included the following.

- Level boarding.
- Common platform heights (Caltrain/HST).

5.4.1.7 Traction Power System Alternatives (other than OCS)

Alternatives related to the traction power system considered included the following.

- Size power to 50% more than need only.
- Alternative paralleling station location in Burlingame north of proposed location.

5.4.1.8 Freight Operations Alternatives

Alternatives related to freight operations considered included the following.

- 23-foot overhead clearance everywhere.
- Maintain existing overhead clearances everywhere.
- Retain existing 8 p.m. to 5 a.m. freight operational window.

5.4.1.9 Overhead Contact System Alternatives

Alternatives related to the OCS considered included the following.

- Center poles along the entire ROW.
- No headspans for any area where speeds in the future might go above 80 mph.
- No square poles.
- Multi-face poles in public areas.

- Reduced diameter and increased thickness poles.
- Wire-tensioning weights housed inside larger diameter poles.
- Feed and return wire underground or on track side of poles.

5.4.1.10 Other Operational Alternatives (assuming Electrification)

Other operational alternatives considered, all assuming electrification, included the following.

- Underground all other utilities as part of the Proposed Project.
- Avoid all ROW takes.
- Install solar panels in the Caltrain ROW.
- Install a bike trail along the Dumbarton ROW bike to Facebook.
- Install pedestrian/bike tunnels for connectivity.
- Install pedestrian/bike trail along rail corridor.
- Update entire corridor with "Quiet Zone" improvements such as quad gates, intrusion and impenetrable barriers at at-grade crossings.
- Allow no further retracking until certified for 125 mph speeds.
- Include Dumbarton Rail Project in the Proposed Project (including holding track up to Fair Oaks Lane or beyond)

5.4.1.11 Construction Alternatives

Construction-related alternatives considered included the following.

- Construction of shoofly tracks.
- Multi-track closures.
- Electrification with OCS Installation by Factory Train.
- No night work.

5.4.2 Screening Process

Alternatives were evaluated as to whether they are feasible, whether they would avoid or substantially lower one or more significant impact of the Proposed Project, and whether they would meet most of the project's purpose and need. If an alternative did not pass a tier, then it was not evaluated for the subsequent tiers.

5.4.2.1 Feasibility Screening (Tier 1)

The first tier of screening involved examining whether potential alternatives are feasible. Only feasible alternatives passed this screening. Feasibility was examined from several different aspects, including the following.

- Technically Feasible—Can the alternative be built using current construction techniques as proposed and operated?

- Logistically Feasible—Can the alternative be implemented taking into account legal, social, or regulatory constraints?
- Financially Feasible—Can the alternative be implemented within the financial capability of the Sponsor?

The results of the Tier 1 screening are presented in Table 5-12 ~~5-7~~ at the end of this chapter.

5.4.2.2 Environmental Impact Screening (Tier 2)

Only those alternatives considered feasible or potentially feasible (per Tier 1) were then examined to see whether they would avoid or substantially reduce one or more significant impacts of the Proposed Project.

An alternative analysis needs to focus on the potential significant impacts of the Proposed Project over existing conditions that may be avoided or substantially reduced with the implementation of a feasible alternative that meets the Proposed Project's basic purposes. Table 5-11 ~~5-6~~ above lists the significant impacts of the Proposed Project identified in Chapter 3, *Settings, Impacts, and Mitigation Measures,* and Chapter 4, *Other CEQA-Required Analysis*. Alternatives need not reduce all impacts of the Proposed Project. Alternatives that would avoid or substantially reduce one or more of the significant impacts were considered to pass this level of screening. The significant impacts of the Proposed Project that were the focus of the environmental screening were as follows.

- Construction (all resource areas)
    - Construction disruption (air quality, cultural resources, noise, traffic, and other subject areas).
- Operations
    - Aesthetics
        - Aesthetic impacts due to overhead contact system (OCS) appearance or tree removal.
    - Noise
        - Change in noise levels along the Caltrain right-of-way (ROW).
    - Traffic
        - Increased roadway traffic delays at at-grade crossings or near Caltrain stations.

The results of the Tier 2 screening are presented in Table 5-13 ~~5-8~~ at the end of this chapter.

5.4.2.3 Purpose and Need Screening (Tier 3)

Only those alternatives determined to be feasible (or potentially feasible) and that would avoid or substantially lower one or more significant impacts of the Proposed Project were evaluated in Tier 3.

The final tier of screening involved evaluating whether potential alternatives met the Proposed Project's Purpose and Need, which is described in detail in Chapter 1*, Introduction*. CEQA does not require alternatives to be analyzed if they do not meet most of a project's basic objectives; for the purpose of this Draft EIR, the basic objectives are considered to be the primary purposes identified in Chapter 1, *Introduction*. If an alternative met most, if not all, of the purposes, it was considered to pass Level 1 screening.

The primary objectives ~~purposes~~ of the Proposed Project, as described in Chapter 1, *Introduction,* are as follows.

- Improve train performance, increase ridership, and increase service.
- Increase revenue and reduce fuel cost.
- Reduce environmental impact by reducing noise emanating from trains.
- Reduce environmental impact by improving regional air quality and reducing greenhouse gas emissions.
- Provide electrical infrastructure compatible with high-speed rail.

The results of the Tier 3 screening are presented in Table 5-14 ~~5-9~~ at the end of this chapter.

5.4.3 Alternatives Screening Results and Conclusions

The overall results of the screening evaluation of the 52~~51~~ alternatives (other than the No Project Alternative) are summarized in Table 5-15 ~~5-10~~ at the end of this chapter and below:

- Tier 1 (Feasibility)—Half (27 ~~25~~) of the alternatives are considered feasible; three alternatives are of questionable feasibility; the remainder (22 ~~23~~) of the alternatives are not considered feasible.
- Tier 2 (Environmental Impact)—Of the 30 ~~28~~ feasible or potentially feasible alternatives, only 13 ~~12~~ would avoid or substantially reduce one or more significant impacts of the Proposed Project.
- Tier 3 (Purpose and Need)—Of the 13 ~~12~~ feasible or potentially feasible alternatives that would reduce significant impacts, eight of them would meet the project's purpose and need, ~~two~~three would ~~not~~ only meet some of the project's purpose and need ~~but were carried forward due to public~~ interest, and two would not meet project's purpose and need and were not carried forward.
- After eliminating the 41 alternatives that failed either the Tier 1, Tier 2, or Tier 3 screening (other than the No Project Alternative), 11 ~~10~~ potential alternatives remained (other than the No Project Alternative).
- Of these 11 ~~10~~ alternatives, seven of them are analyzed as part of the project as follows.
  - The following alternative is included as a construction method in this Draft EIR.
    - Multi-track closures.
  - The following are included as options in Mitigation Measure AES-2b:
    - No square poles.
    - Multi-face poles in public areas.
    - Reduced diameter and increased thickness poles.
    - House wire-tensioning eights inside larger diameter poles (if feasible).
    - Feed and return wire ~~underground or~~ on track side of poles (if feasible).
  - The following alternative is included as consideration for Mitigation Measure NOI-CUMUL-1 for addressing cumulative noise impacts.

- Update entire corridor with "quiet zone" improvements.

- This Draft EIR analyzes the <u>four</u> ~~three~~ remaining alternative in this chapter along with the No Project Alternative:
  - DMU Alternative.
  - Dual-Mode MU alternative.
  - <u>Tier 4 Diesel Locomotive Alternative.</u>
  - Electrification with OCS installation by Factory Train.

Table 5-12 ~~5-7~~. Alternatives Screening, Tier 1 (Feasibility)

No.	Name	Technically Feasible?	Logistically Feasible?	Financially Feasible?	Otherwise Feasible?	PASS?	Notes
NP	No Project Alternative	Yes	Yes	Yes	Yes	**Yes**	
Project	Proposed Project	Yes	Yes	Yes	Yes	**Yes**	
Technology Alternatives							
T1	Electric Locomotives	Yes	Yes	Yes	Yes	**Yes**	
T2	Diesel Multiple Units	Yes	Yes	Yes	Yes	**Yes**	Feasible to operate from Gilroy to San Francisco 4th and King Station but not feasible for service to TTC, which is not designed for diesel trains. Would require platform extensions at most Caltrain stations.
T3	Dual-Mode Multiple Units (or Locomotives)	Yes	Yes	Yes	Yes	**Yes**	
T4	Caltrain Third-Rail Alternative	Yes	Unk	No	Yes	No	See description below for BART, which is a third-rail system. A third-rail system would have to be grade separated the entire way including substantial ROW and station modifications between SF and Santa Clara (BART connection). Using the costs below for a BART extension, a 51.4-mile third-rail system from SF to Tamien could cost $8 billion to $9 billion.
T5	Extend BART from Millbrae to Santa Clara	Yes	Yes	No	Unk	No	Insufficient funding: BART extensions can cost hundreds of millions per mile. The Warm Springs Extension was 5.4 miles at cost of $890 million (http://www.bart.gov/about/projects/wsx/index.aspx). The San Francisco International Airport (SFO) Extension was 8.7 miles at a cost of $1.5 billion. Using these costs, a Millbrae (MP 13.6) to Santa Clara (MP 44.9) extension (30.7 miles, due to 0.6-mile offset) could cost $5.1 to $5.3 billion.
T6	100% Electrified Service by 2020 ~~2019~~	Yes	Yes	No	Yes	No	The estimated cost of rolling stock for the Proposed Project is $524 to 576 ~~$440~~ million, which will provide 75% electrified service from SF to Tamien. ~~Using these~~ costs Including the costs for additional rolling stock, electrifying 100% of the service could cost $786 to 860~~$590~~ million, or an additional $262 to 287 million ~~$150~~ million, which has not been secured by Caltrain.

No.	Name	Technically Feasible?	Logistically Feasible?	Financially Feasible?	Otherwise Feasible?	PASS?	Notes
T7	Tier 4 Diesel Locomotive Alternative	Yes	Yes	Yes	Yes	**Yes**	
Electrified Train Design Alternatives							
TD1	125 mph Trains	Yes	Yes	Yes	Yes	**Yes**	
TD2	Single-Level with < 30-Second Dwell Times	Yes	No	Yes	Yes	No	Would have inadequate seats to meet projected demand.
TD3	Wifi	Yes	Yes	Yes	Yes	**Yes**	
TD4	< 60-Second Coupling/ Decoupling	Yes	Yes	Yes	Yes	**Yes**	
Horizontal Alignment Alternatives							
HA1	San Francisco Alternative Alignment (to 3rd Street/King)	Yes	No	No	Yes	No	No specific feasibility study has been done of this alignment, but given the lack of existing ROW and existing development, the additional construction of the new alignment would require substantial construction works, including extensive underground tunneling as well as new underground stations at 3rd Street. By way of comparison, the original design for high-speed rail (HSR) approaching SF which included extensive undergrounding from around 23rd Street to the 4th and King Station (distance of 1.3 miles) at a cost for an underground option of $348 million, which does not include costs of a new station. The alternative is inconsistent with adopted DTX/TTC plans and thus logistically considered infeasible due to the substantial delay to DTX completion to redesign an entirely new approach.
Vertical Alignment Alternatives							
VA1	San Francisco Undergrounding	Yes	Unk	No	Yes	No	No specific feasibility study has been done of underground for Caltrain. The original design for HSR approaching SF (see Supplemental AA, 2010) included extensive undergrounding from around 23rd street to the 4th and King Station (distance of 1.3 miles) at a cost for an underground option of $348 million, excluding ROW acquisition costs as needed. The Proposed Project would not require any undergrounding.

No.	Name	Technically Feasible?	Logistically Feasible?	Financially Feasible?	Otherwise Feasible?	PASS?	Notes
VA2	Buried Trench	Yes	Yes	No	Yes	No	No specific feasibility study has been done of a buried trench alternative for Caltrain. The original design for HSR on the Peninsula included a two-track buried trench option (see Supplemental AA, 2010). The costs for an open trench option in Palo Alto from the California High-Speed Rail Authority (CHSRA) *Supplemental AA Report* (2010) were estimated as $513 million for 2.7 miles ($190 million/mile). Using this average per mile amount, the gross cost for a buried trench for the entire 51.4 miles would be $9.8 billion. Even if only half the route were put in a buried trench (in the most sensitive areas for example), the cost for the buried trench sections could still be $4.9 billion in addition to the cost of electrification for the other at-grade half (of $393 million), for a total of $5.3 billion.
VA3	Fully Grade Separated	Yes	Yes	No	Yes	No	There are an estimated 45 at-grade crossings on the route (42 after the San Bruno Grade Separation project). Grade separation costs are highly site-specific and thus can vary dramatically. No feasibility study has been done of every at-grade crossing. However, using the San Bruno grade separation costs ($147 million for three at-grade crossings for an average of $49 million each), if all 42 remaining at-grade crossing were grade separated, the additional cost could be $2 billion, which would more than double the project cost.
VA4	Elevated Alignment in Menlo Park	Yes	Yes	No	No	No	A specific feasibility study has not been conducted of this alternative. However, using the Preliminary AA costs for the high-speed rail elevated section for a 1.7 mile segment in Atherton/Menlo Park, which was estimated to cost $166 million for a 2-track option ($178 million for a four-track option), cost per mile is $98 to $105 million. Menlo Park section of ROW is approximately 1.6 miles, and thus cost would be about $156 to $168 million.

No.	Name	Technically Feasible?	Logistically Feasible?	Financially Feasible?	Otherwise Feasible?	PASS?	Notes
Electrification Location Alternatives							
E1	Electric Only in SF	Yes	Yes	Yes	Yes	**Yes**	
E2	Do Not Electrify Maintenance Facilities	Yes	No	Yes	Yes	No	Need electrified maintenance facilities to maintain trains.
E3	Electrify Minimum Number of CEMOF Tracks	Yes	No	Yes	Yes	No	Limits operational flexibility.
E4	Electrify Minimum Number of Diridon Platforms	Yes	No	Yes	Yes	No	Limits operational flexibility.
Electrified Service Alternatives							
S1	5 Trains pphpd with 6-Car Consists	Yes	Yes	Yes	Yes	**Yes**	
S2	5 Trains pphpd with 8-Car Consists	Yes	Yes	Yes	Yes	**Yes**	
S3	8 Trains pphpd with 6-Car Consists	Yes	Yes	Yes	Yes	**Yes**	
S4	26 Trains/Day between San Jose and Gilroy	Yes	~~Yes~~ No	No	Yes	No	Insufficient demand to justify expense. Electrification Infrastructure Costs from San Jose to San Francisco (51.4 miles) is $950 to $958 ~~$785~~ million. Based on this, the cost to electrify the additional 26 miles of dual track ~~from San Francisco~~ from south of Tamien to Gilroy (52 track ~~77~~ miles not counting any yard or siding track) would be approx. additional $353 to $356 million bringing total infrastructure costs to $1.3 ~~$1.175~~ billion, not including cost of additional rolling stock to replace diesel trains servicing Gilroy and expand service from six trains per day at present. Costs may be lower through use of a factory train. Regardless of cost, Union Pacific is on record as being opposed to electrifying any tracks that it owns making this alternative infeasible

No.	Name	Technically Feasible?	Logistically Feasible?	Financially Feasible?	Otherwise Feasible?	PASS?	Notes
S5	Gilroy/Blossom Hill Turnaround instead of Tamien	Yes	~~Yes~~ No	No	Yes	No	Would require electrification of tracks within UPRR south of Tamien, which could introduce additional potential conflicts with freight and would require UPRR permission. Costs to electrify to Gilroy noted above. Costs to electrify from Tamien to Blossom Hill (approximately 3.5 miles of dual track for 7 track miles) using project average cost per track mile would be approximately $27 ~~$53.5~~ million in additional cost. Costs may be lower through use of a factory train. Regardless of cost, Union Pacific is on record as being opposed to electrifying any tracks that it owns making this alternative infeasible
Platform Alternatives							
P1	Level Boarding	Yes	Yes	Yes	Yes	**Yes**	
P2	Common Platform Heights (Caltrain/HST)	Yes	Yes	Yes	Yes	**Yes**	Common platform heights would only be needed at shared stations if both Caltrain and HSR used the same platform. At present, HSR would have dedicated platforms at TTC, Millbrae, and Diridon (and possibly at Redwood City if selected as a HSR station). Common platform heights would require common decisions on vehicle designs between Caltrain and HSR. Because there is no proposal to share platforms at present and no platform improvements in the Proposed Project, this is not an alternative to the Proposed Project.
Traction Power System Alternatives (other than OCS)							
TPS1	Size Power to 50% More than Need Only	Yes	Yes	Yes	Yes	**Yes**	
TPS2	Alternative TPS Location (Burlingame)	Yes	Yes	Yes	Yes	**Yes**	

No.	Name	Technically Feasible?	Logistically Feasible?	Financially Feasible?	Otherwise Feasible?	PASS?	Notes
Freight Operations Alternatives							
F1	23-Foot Overhead Clearance Everywhere	Yes	Yes	No	Yes	No	Would require reconstruction of all four SF tunnels as well as either lowering tracks or raising bridges at other locations to provide for additional clearance. Tunnels would all need additional clearance. Full replacement of all four tunnels (2.3 miles), using CHSRA estimates for 2-track new tunnel cost of $278 million/mile could cost $650 million additional. Costs to lower tracks to expand existing tunnels not estimated. Costs of lowering tracks or raising bridges at other locations not estimated.
F2	Maintain Existing Overhead Clearances Everywhere	Yes	Yes	~~Unk~~ No	Yes	~~**TBD**~~ No	Would require lowering tracks, or notching or reconstructing tunnels beyond that proposed in the Project to provide additional clearance to compensate for the effect of OCS on overhead clearance. Would require rebuild or replacement of San Francisquito Bridge.
F3	8 p.m. to 5 a.m. Freight Operations	Yes	Yes ~~No~~	Yes	Yes ~~No~~	**Yes** ~~No~~	While not currently allowed by Federal Railroad Administration (FRA) waiver, Caltrain is now of the opinion that alternative compliant EMUs and freight equipment can operate on the corridor without temporal separation because EMUs can provide equivalent safety to Tier 1 passenger safety requirements and due to the forthcoming FRA rule-making. Thus, the project now assumed no substantial change in freight operational windows. As such this is now an assumption of the EIR and not an alternative.
OCS Alternatives							
OCS1	100% Center Pole	Yes	No	Yes	Yes	No	Insufficient track separation in many areas. Center poles are one option being considered as mitigation where feasible.
OCS2	No Headspans for > 80 mph	Yes	Yes	Yes	Yes	**Yes**	
OCS3	No Square Poles	Yes	Yes	Yes	Yes	**Yes**	
OCS4	Multi-Face Poles in Public Areas	Yes	Yes	Yes	Yes	**Yes**	

No.	Name	Technically Feasible?	Logistically Feasible?	Financially Feasible?	Otherwise Feasible?	PASS?	Notes
OCS5	Reduced Diameter and Increased Thickness	Yes	Yes	Yes	Yes	**Yes**	
OCS6	House Wire-Tensioning Weights inside Larger Diameter Poles	Unk	Yes	Yes	Yes	**TBD**	Engineering checking feasibility as part of aesthetic mitigation
OCS7	Run Feed and Return Wire Underground or on Track Side of Poles	Unk	Yes	Yes	Yes	**TBD**	Engineering checking feasibility as part of aesthetic mitigation
Other Alternatives (all assume electrification)							
O1	Underground all Other Utilities	Yes	Yes	Yes	Yes	**Yes**	
O2	Avoid all ROW Takes	No	Yes	Yes	Yes	No	Impossible to avoid ROW takes for traction power substations and electrical clearance where ROW is too narrow.
O3	Solar in the Caltrain ROW	Yes	No	Unk	Yes	No	Incompatible with rail operational safety.
O4	Dumbarton ROW Bike Trail to Facebook	Yes	No	Yes	Yes	No	Incompatible with rail operational safety.
O5	Pedestrian/Bike Tunnels for Connectivity	Yes	Yes	Unk	Yes	**Yes**	
O6	Bike/Pedestrian Trail along Rail Corridor	Yes	No	Unk	Yes	No	Incompatible with rail operational safety.

No.	Name	Technically Feasible?	Logistically Feasible?	Financially Feasible?	Otherwise Feasible?	PASS?	Notes
O7	Update Entire Corridor with "Quiet Zone" Improvements	Yes	Yes	Unk	Yes	**Yes**	As described in Section 3.11, *Noise and Vibration*, a quiet zone can only be proposed to the FRA by a local jurisdiction (not by ~~a~~ train operators). 42 at-grade crossings will remain after San Bruno grade separation project completed. Costs per crossing can range up to $1 million to $2 million for 4-quadrant gates. If all 42 at-grade crossings got quad gates at the high end of cost range, total cost could be up to $42 to $84 million. This is not financially feasible as part of the Proposed Project, but may be fundable in the long-run through local, state, and federal funds.
O8	No Further Retracking until Certified for 125 mph	Yes	Yes	Yes	Yes	**Yes**	
O9	Include Dumbarton Rail Project in the Proposed Project	Yes	No	No	Yes	No	Proposed Project funding does not include DRC; DRC is a separate project that is not fully funded at present.
Construction Alternatives							
C1	Construction Shoofly Tracks	Yes	Yes	No	Yes	No	Caltrain analyzed and found to be prohibitively expensive for this project (and highly disruptive to build).
C2	Multi-Track Closures	Yes	Yes	Yes	Yes	**Yes**	
C3	Electrification with OCS Installation by Factory Train	Yes	Yes	Unk	Yes	**Yes**	
C4	No Night Work	Yes	Yes	Yes	Yes	**Yes**	

Table 5-13 ~~5-8~~. Alternatives Screening, Tier 2 (Environmental Impact)

No.	Name	Increased Horn Noise?	Roadway Traffic Delays at At-Grade Crossings?	Roadway Traffic Delays Near Stations?	Aesthetic Impacts due to OCS Appearance?	Tree Removal?	Construction Disruption?	Other Impact (see notes)?	Avoids or Substantially Reduced One or More Project Impacts?	Notes
NP	No Project Alternative	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**	Other impacts avoided/reduced: no new impervious surfaces, but the Proposed Project's impact due to impervious surface would be less than significant.
Project	Proposed Project	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	
Technology Alternatives										
T1	Electric Locomotives	No	No	No	No	No	No	No	No	Would not avoid any project-level impacts over baseline.
T2	Diesel Multiple Units	No	No	No	Yes	Yes	Yes	Yes	**Yes**	Also avoids impacts associated with TPS noise.
T3	Dual-Mode Multiple Units with no Electrification from San Jose to San Francisco	No	No	No	Yes	Yes	Yes	Yes	**Yes**	Presuming diesel operations from San Jose to San Francisco 4th and King Station and electrified operations from 4th and King Station to TTC. Also avoids impacts associated with TPS noise.
	Dual-Mode Locomotives with Electrification from San Jose to San Francisco	No	No	No	No	No	No	No	No	Would not avoid any project-level impacts over baseline.
T7	Tier 4 Diesel Locomotive Alternative	No	No	No	Yes	Yes	Yes	Yes	**Yes**	Also avoids impacts associated with TPS noise
Electrified Train Design Alternatives										
TD1	125 mph Trains	No	No	No	No	No	No	No	No	Would not avoid any project-level impacts over baseline.
TD3	Wifi	No	No	No	No	No	No	No	No	Would not avoid any project-level impacts over baseline.

No.	Name	Increased Horn Noise?	Roadway Traffic Delays at At-Grade Crossings?	Roadway Traffic Delays Near Stations?	Aesthetic Impacts due to OCS Appearance?	Tree Removal?	Construction Disruption?	Other Impact (see notes)?	Avoids or Substantially Reduced One or More Project Impacts?	Notes
TD4	< 60-Second Coupling/Decoupling	No	No	No	No	No	No	No	No	Project does not propose split service, so would not lower any project-level impacts over baseline.
Electrification Location Alternatives										
E1	Electric Only in SF	No	No	No	No	No	No	No	No	Would lower air quality impacts of continuing diesel service from Gilroy to SF, but this is an existing condition, not a project condition.
Electrified Service Alternatives										
S1	5 Trains pphpd with 6-Car Consists	Yes	Yes	Yes	No	No	No	No	**Yes**	
S2	5 Trains pphpd with 8-Car Consists	Yes	Yes	No	No	No	No	No	**Yes**	
S3	8 Trains pphpd with 6-Car Consists	No	No	No	No	No	No	No	No	Would not avoid any project-level impacts over baseline.
Platform Alternatives										
P1	Level Boarding	No	No	No	No	No	No	No	No	Would not avoid any project-level impacts over baseline.
P2	Common Platform Heights (Caltrain/HST)	No	No	No	No	No	No	No	No	Would not avoid any project-level impacts over baseline.
Traction Power System Alternatives (other than OCS)										
TPS1	Size Power to 50% More than Need Only	No	No	No	No	No	No	No	No	Would only affect capacity/footprint at traction power substations in industrial/ commercial areas, not sensitive areas.
TPS2	Alternative TPS Location (Burlingame)	No	No	No	No	No	No	No	No	Relocation north would not reduce aesthetic impact.

No.	Name	Increased Horn Noise?	Roadway Traffic Delays at At-Grade Crossings?	Roadway Traffic Delays Near Stations?	Aesthetic Impacts due to OCS Appearance?	Tree Removal?	Construction Disruption?	Other Impact (see notes)?	Avoids or Substantially Reduced One or More Project Impacts?	Notes
Freight Operations Alternatives										
F2	Maintain Existing Overhead Clearances Everywhere	No	No	No	No	No	No	Yes	**Yes**	Would reduce potential diversion of existing rail to truck however the Proposed Project would accommodate existing freight and cumulative effects on freight are considered to have less than significant environmental impact .
F3	8 p.m. to 5 a.m. Freight Operations	No	No	No	No	No	No	No	**No**	Since this is now part of the Proposed Project, it would not avoid any impacts of the Proposed Project.
OCS Alternatives										
OCS2	No Headspans for > 80 mph	No	No	No	No	No	No	No	No	Would not avoid any project-level impacts over baseline (project < 79 mph).
OCS3	No Square Poles	No	No	No	Yes	No	No	No	**Yes**	
OCS4	Multi-Face Poles in Public Areas	No	No	No	Yes	No	No	No	**Yes**	
OCS5	Reduced Diameter and Increased Thickness	No	No	No	Yes	No	No	No	**Yes**	
OCS6	House Wire-Tensioning Weights inside Larger Diameter Poles	No	No	No	Yes	No	No	No	**Yes**	
OCS7	Run Feed and Return Wire Underground or on Track Side of Poles	No	No	No	Yes	Yes	Yes	No	**Yes**	
Other Alternatives (all assume electrification)										
O1	Underground All other Utilities	No	No	No	No	No	No	No	No	Would lower aesthetic impact of existing utilities, but that is a baseline impact not a project impact.

No.	Name	Increased Horn Noise?	Roadway Traffic Delays at At-Grade Crossings?	Roadway Traffic Delays Near Stations?	Aesthetic Impacts due to OCS Appearance?	Tree Removal?	Construction Disruption?	Other Impact (see notes)?	Avoids or Substantially Reduced One or More Project Impacts?	Notes
O5	Pedestrian/Bike Tunnels for Connectivity	No	No	No	No	No	No	No	No	Proposed Project maintains existing pedestrian–bike connectivity.
O7	Update Entire Corridor with "Quiet Zone" Improvements	Yes	No	No	No	No	No	No	**Yes**	
O8	No Further Retracking until Certified for 125 mph	No	No	No	No	No	No	No	No	Would not avoid any project-level impacts over baseline.
Construction Alternatives										
C2	Multi-Track Closures	No	No	No	No	No	Yes	No	**Yes**	Would reduce construction duration.
C3	Electrification with OCS Installation by Factory Train	No	No	No	No	No	Yes	No	**Yes**	Would reduce construction disruption.
C4	No Night Work	No	No	No	No	No	No	No	No	Would reduce construction disruption at night, but lengthen construction duration overall.

Table 5-14 ~~5-9~~. Alternatives Screening, Tier 3 (Purpose and Need)

No.	Name	Improve Train Performance, ridership and service	Increase operating revenue and reduce operating fuel costs	Reduce engine noise from trains compared with existing diesel trains	Improve air quality	Reduce Greenhouse Gas Emissions	Electrification infrastructure Compatible with High-Speed Rail	PASS?	Notes
NP	No Project Alternative	No	No	No	No	No	No	**Yes**	CEQA requires analysis of No Project Alternative
Project	Proposed Project	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**	
Technology Alternatives									
T2	Diesel Multiple Units	Yes	Yes (fare revenue) No (fuel costs)	Yes	Yes	Yes	No	**Partially ~~No~~**	Would not meet project's purpose to provide electrification compatible with HSR and would not reduce operating fuel costs. Meets some of Purpose and Need. Carried forward ~~due to Public interest~~
T3	Dual-Mode Multiple Units (with no electrification from San Jose to San Francisco)	Yes	Yes (fare revenue) No (fuel costs)	Yes	Yes	Yes	No	**Partially ~~No~~**	Would not meet project's purpose to provide electrification compatible with HSR and would not reduce operating fuel costs. Meets some of Purpose and Need. Carried forward ~~due to Public interest~~
T7	Tier 4 Diesel Locomotive Alternative	Yes	Yes (fare revenue) No (fuel costs)	No	Yes	Yes	No	**Partially**	Would not meet project's purpose to provide electrification compatible with HSR, would not reduce operating fuel costs and would not lower engine noise. Meets some of Purpose and Need. Carried forward.

No.	Name	Improve Train Performance, ridership and service	Increase operating revenue and reduce operating fuel costs	Reduce engine noise from trains compared with existing diesel trains	Improve air quality	Reduce Greenhouse Gas Emissions	Electrification infrastructure Compatible with High-Speed Rail	PASS?	Notes
Electrified Service Alternatives									
S1	5 Trains pphpd with 6-Car Consists	No	No	Yes	Yes	Yes	Yes	No	
S2	5 Trains pphpd with 8-Car Consists	No	No	Yes	Yes	Yes	Yes	No	Would not increase service and thus may not increase ridership.
OCS Alternatives									
OCS3	No Square Poles	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**	
OCS4	Multi-Face Poles in Public Areas	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**	
OCS5	Reduced Diameter and Increased Thickness	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**	
OCS6	House Wire-Tensioning Weights inside Larger Diameter Poles	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**	
OCS7	Run Feed and Return Wire Underground or on Track Side of Poles	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**	
Other Alternatives (all assume electrification)									
O7	Update Entire Corridor with "Quiet Zone" Improvements	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**	
Construction Alternatives									
C2	Multi-Track Closures	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**	
C3	Electrification with OCS Installation by Factory Train	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**	

Table 5-15 ~~5-10~~. Alternatives Screening, Results

No.	Name	Feasible?	Avoids or substantially Reduces one or More Impacts of the Project	Meets Purpose and Need?	*Potentially Analyzed in the EIR?*	Expands Range of Alternatives	Recommended for Analysis in the EIR	Notes
NP	No Project Alternative	Yes	Yes	No	*Yes*	Yes	**Yes**	Required by CEQA.
Project	Proposed Project	Yes	No	Yes	*Yes*	Yes	**Yes**	Proposed Project.
Technology Alternatives								
T1	Electric Locomotives	Yes	No	N/A	*No*	N/A	No	Would not avoid or substantially lower significant impacts of the project.
T2	Diesel Multiple Units	Yes	Yes	No	*Yes*	Yes	**Yes**	Although does not meet project purpose and need to lower operating fuel costs and to provide electrical infrastructure compatible with high-speed train (HST), alternative is analyzed in EIR ~~due to public interest~~.
T3	Dual Mode Multiple Units (with no electrification from San Jose to San Francisco)	Yes	Yes	No	*Yes*	Yes	**Yes**	Although does not meet project purpose and need to lower operating fuel costs and to provide electrical infrastructure compatible with high-speed train (HST), alternative is analyzed in EIR ~~due to public interest~~.
	Dual Mode Locomotives (with electrification from San Jose to San Francisco)	Yes	No	N/A	*No*	N/A	No	Would not avoid or substantially lower significant impacts of the project.
T4	Caltrain Third-Rail Alternative	No	N/A	N/A	*No*	N/A	No	Not considered feasible
T5	Extend BART from Millbrae to Santa Clara	No	N/A	N/A	*No*	N/A	No	Not considered feasible
T6	100% Electrified Service by 2020 ~~2019~~	No	N/A	N/A	*No*	N/A	No	Not considered feasible

No.	Name	Feasible?	Avoids or substantially Reduces one or More Impacts of the Project	Meets Purpose and Need?	*Potentially Analyzed in the EIR?*	Expands Range of Alternatives	Recommended for Analysis in the EIR	Notes
T7	Tier 4 Diesel Locomotive Alternative	Yes	Yes	Some	*Yes*	No	**Yes**	Although does not meet project purpose and need to lower operating fuel costs, to lower engine noise, and to provide electrical infrastructure compatible with high-speed train (HST), alternative is analyzed in EIR. It should be noted that with two diesel-based DMU Alternative and Dual-Mode Alternatives, which meet more of the project objectives, and a No Project Alternative that continues use of diesel locomotives, this alternative doesn't meaningfully expand the range of alternatives.
Electrified Train Design Alternatives								
TD1	125 mph Trains	Yes	No	N/A	*No*	N/A	No	Trains can do 125 mph but this would not lower any impacts of the project.
TD2	Single-Level with < 30-Second Dwell Times	No	N/A	N/A	*No*	N/A	No	Not considered feasible
TD3	Wifi	Yes	No	N/A	*No*	N/A	No	Would not avoid or substantially lower significant impacts of the project.
TD4	< 60-Second Coupling/Decoupling	Yes	No	N/A	*No*	N/A	No	Would not avoid or substantially lower significant impacts of the project.
Horizontal Alignment Alternatives								
HA1	San Francisco Alternative Alignment (to 3rd Street/King)	No	N/A	N/A	*No*	N/A	No	Not considered feasible
Vertical Alignment Alternatives								
VA1	San Francisco Undergrounding	No	N/A	N/A	*No*	N/A	No	Not considered feasible
VA2	Buried Trench	No	N/A	N/A	*No*	N/A	No	Not considered feasible
VA3	Fully Grade-Separated	No	N/A	N/A	*No*	N/A	No	Not considered feasible

No.	Name	Feasible?	Avoids or substantially Reduces one or More Impacts of the Project	Meets Purpose and Need?	*Potentially Analyzed in the EIR?*	Expands Range of Alternatives	Recommended for Analysis in the EIR	Notes
VA4	Elevated Alignment in Menlo Park	No	N/A	N/A	*No*	N/A	No	Not considered feasible
Electrification Location Alternatives								
E1	Electric Only in SF	Yes	No	N/A	*No*	N/A	No	Would not avoid or substantially lower significant impacts of the project.
E2	Do Not Electrify Maintenance Facilities	No	N/A	N/A	*No*	N/A	No	Not considered feasible
E3	Electrify Minimum Number of CEMOF Tracks	No	N/A	N/A	*No*	N/A	No	Not considered feasible
E4	Electrify Minimum Number of Diridon Platforms	No	N/A	N/A	*No*	N/A	No	Not considered feasible
Electrified Service Alternatives								
S1	5 Trains pphpd with 6-Car Consists	Yes	Yes	No	*No*	N/A	No	Would not meet project's purpose and need.
S2	5 Trains pphpd with 8-Car Consists	Yes	Yes	No	*No*	N/A	No	Would not meet project's purpose and need.
S3	8 Trains pphpd with 6-Car Consists	Yes	No	N/A	*No*	N/A	No	Would not avoid or substantially lower significant impacts of the project.
S4	26 Trains/Day between San Jose and Gilroy	No	N/A	N/A	*No*	N/A	No	Not considered feasible
S5	Gilroy/Blossom Hill Turnaround Instead of Tamien	No	N/A	N/A	*No*	N/A	No	Not considered feasible
Platform Alternatives								
P1	Level Boarding	Yes	No	N/A	*No*	N/A	No	Would not avoid or substantially lower significant impacts of the project. Future level boarding not precluded by Proposed project.
P2	Common Platform Heights (Caltrain/HST)	Yes	No	N/A	*No*	N/A	No	

No.	Name	Feasible?	Avoids or substantially Reduces one or More Impacts of the Project	Meets Purpose and Need?	*Potentially Analyzed in the EIR?*	Expands Range of Alternatives	Recommended for Analysis in the EIR	Notes
Traction Power System Alternatives (other than OCS)								
TPS1	Size Power To 50% More Than Need Only	Yes	No	N/A	*No*	N/A	No	Would not avoid or substantially lower significant impacts of the project
TPS2	Alternative TPS Location (Burlingame)	Yes	No	N/A	*No*	N/A	No	Would not avoid or substantially lower significant impacts of the project
Freight Operations Alternatives								
F1	23-Foot Overhead Clearance Everywhere	No	N/A	N/A	*No*	N/A	No	Not considered feasible
F2	Maintain Existing Overhead Clearances Everywhere	TBD	Yes	Yes	*Yes*	Yes	**Project**	Potentially feasible, but would result in substantial impact, especially to historic tunnels. Would not lower impacts of the Proposed Project over baseline. Analyzed as part of cumulative mitigation for potential future impacts on freight service.
F3	8 p.m. to 5 a.m. Freight Operations	Yes ~~No~~	No ~~N/A~~	N/A	*No*	N/A	No	~~Not considered feasible.~~ Proposed Project now presumes no need for temporal separation so this alternative would not avoid any impacts of the Proposed Project.
OCS Alternatives								
OCS1	100% Center Pole	No	N/A	N/A	*No*	N/A	No	Not considered feasible
OCS2	No Headspans for > 80 mph	Yes	No	N/A	*No*	N/A	No	Would not avoid or substantially lower significant impacts of the project
OCS3	No Square Poles	Yes	Yes	Yes	*Yes*	No	**Project**	Considered for Aesthetic mitigation.
OCS4	Multi-Face Poles in Public Areas	Yes	Yes	Yes	*Yes*	No	**Project**	Considered for Aesthetic mitigation.
OCS5	Reduced Diameter and Increased Thickness	Yes	Yes	Yes	*Yes*	No	**Project**	Considered for Aesthetic mitigation.

No.	Name	Feasible?	Avoids or substantially Reduces one or More Impacts of the Project	Meets Purpose and Need?	*Potentially Analyzed in the EIR?*	Expands Range of Alternatives	Recommended for Analysis in the EIR	Notes
OCS6	House Wire-Tensioning Weights inside Larger Diameter Poles	TBD	Yes	Yes	*Yes*	No	**TBD**	Considered for Aesthetic mitigation if feasible
OCS7	Run Feed And Return Wire Underground or on Track Side of Poles	TBD	Yes	Yes	*Yes*	No	**TBD**	Considered for Aesthetic mitigation if feasible.
Other Alternatives (all assume electrification)								
O1	Underground all Other Utilities	Yes	No	N/A	*No*	N/A	No	Would not avoid or substantially lower significant impacts of the project
O2	Avoid all ROW Takes	No	N/A	N/A	*No*	N/A	No	Not considered feasible
O3	Solar in the Caltrain ROW	No	N/A	N/A	*No*	N/A	No	Not considered feasible
O4	Dumbarton ROW Bike Trail to Facebook	No	N/A	N/A	*No*	N/A	No	Not considered feasible
O5	Pedestrian/Bike Tunnels for Connectivity	Yes	No	N/A	*No*	N/A	No	Would not avoid or substantially lower significant impacts of the project
O6	Bike/Pedestrian Trail along Rail Corridor	No	N/A	N/A	*No*	N/A	No	Not considered feasible
O7	Update Entire Corridor with "Quiet Zone" Improvements	Unk	Yes	Yes	*Yes*	Yes	**Project/ Cumulative**	Consider quiet zone improvements as potential mitigation where noise effects are identified as significant. Not considered feasible for all at-grade crossings in corridor as part of the Proposed Project but may be fundable in the long-term through the combination of local, state and federal funds and funding participation of other rail operators and local municipalities.
O8	No Further Retracking until Certified for 125 mph	Yes	No	N/A	*No*	N/A	No	Would not avoid or substantially lower significant impacts of the project

No.	Name	Feasible?	Avoids or substantially Reduces one or More Impacts of the Project	Meets Purpose and Need?	*Potentially Analyzed in the EIR?*	Expands Range of Alternatives	Recommended for Analysis in the EIR	Notes
O9	Include Dumbarton Rail Project in the Proposed Project	No	N/A	N/A	*No*	N/A	No	Not considered feasible
Construction Alternatives								
C1	Construction Shoofly Tracks	No	N/A	N/A	*No*	N/A	No	Not considered feasible
C2	Multi-Track Closures	Yes	Yes	Yes	*Yes*	Yes	**Project**	Analyzed as part of the Proposed Project.
C3	Electrification with OCS Installation by Factory Train	Yes	Yes	Yes	*Yes*	Yes	**Yes**	Analyzed as alternative in this chapter
C4	No Night Work	Yes	No	N/A	*No*	N/A	No	Would not avoid or substantially lower significant impacts of the project

Chapter 6
Report Preparation

The CEQA Lead Agency for this EIR is the Peninsula Corridor Joint Powers Board (JPB).

This EIR was prepared for the JPB by ICF International (ICF) and its subcontractors Circlepoint (Scoping and Outreach), Environmental Vision (visual simulations), Fehr & Peers (transportation analysis), HortScience (Tree survey and assessment), and Wilson Ihrig & Associates (noise analysis). This chapter lists the primary individuals who prepared the report (ICF and subconsultants).

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Chapter 7
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